GALLATIN NATIONAL FOREST

AVALANCHE CENTER

2002-2003 Annual Report

GALLATIN NATIONAL FOREST AVALANCHE CENTER

ANNUAL REPORT

2002-2003

by

Doug Chabot

Gallatin National Forest Avalanche Center
P.O. Box 130
Bozeman, MT 59771
(406) 587-6984
web page: http://www.mtavalanche.com
e-mail: gnfac@avalanche.org

Ashley Van Etten of Willywaw.com donated the artwork for this years cover. Ashley is a professional illustrator and designer who loves backcountry skiing. From this passion, she and her husband Joe started Willywaw creating Backcountry Planners and the popular Avalanche Booklet.

The Gallatin National Forest Avalanche Center (GNFAC) is a unique partnership of the Forest Service, Fish Wildlife and Parks, other federal and state agencies and businesses in the national and local outdoor community. All of these entities make it possible for the GNFAC to pursue its goal of putting out daily avalanche advisories in addition to teaching high quality education programs targeting all outdoor recreationists.

ACKNOWLEDGMENTS

Every year the community support to the Avalanche Center increases. This support comes in the way of money, product and time from many companies and individuals. These partnerships allow us to increase public awareness and education about avalanches every year. We again thank those businesses and agencies that have provided significant contributions (in excess of $1000) this past season:

Friends of the Avalanche Center and Hans Saari Memorial Fund
Montana Fish, Wildlife and Parks Recreation Trails Grant
Bridger Bowl
Drew and Jennifer Seessel
USFS Region 1
Greater Yellowstone Coordinating Committee
Montana Fish, Wildlife and Parks Snowmobile Safety Program
Gallatin County Search and Rescue
Nike
Backcountry Access
Surfrider Foundation
Team Bozeman and Polaris
Merica Design
Northern Lights Trading Company
Natural Resources Conservation Service

The **Friends of the Avalanche Center** deserves a hearty round of THANKS! These dedicated individuals help us in countless ways. Most notably they fundraise and write grants to financially support the GNFAC and also provide community outreach. The board includes Molly Merica (President), Drew Seessel, Chas Day, Jeannie Wall, Jay Pape, Greg Caracciolo, Laura Nauman, Jeff Deems, Dale Sexton, Chris Lundy, Annie Fast, Lance Riek, Marty Faulkner, and Cliff Gullett.

The Avalanche Center exists due to the long-term support and encouragement of the **Gallatin National Forest**. The GNF provides a home for the Avalanche Center and has taken leadership in our region for providing a top-notch program of avalanche education and awareness. Kimberly Schlenker, program manager for Recreation and Wilderness, continues to oversee the center, and her invaluable encouragement, assistance and guidance cannot be overemphasized. Her advocacy helped get the center off the ground and has helped it mature and grow throughout the years.

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HISTORY

The idea for a full-time avalanche forecast center in Bozeman dates back to the early 1980s when Montana State University Professor Bob Brown and students Bruce Tremper and Dave Bryar put together a proposal for the state. They managed to elbow their way into a meeting with the governor, but their proposal was eventually turned down. Two years later Chuck Harris, a Forest Service employee in Livingston, got together with Bob Brown and gathered a network of folks from Bridger Bowl and Big Sky Ski Areas, Montana State University, Yellowstone National Park and the Natural Resources Conservation Service (NRCS). The group discussed the current avalanche conditions on a weekly conference call, and Chuck put a short blurb in the newspaper on Fridays. When Chuck left for northwest Montana a few years later, Don Michel, Bridger Bowl's Snow Ranger, took over. Karl Birkeland then took the helm in the 1989-90, and put out weekly advisories while finishing his graduate degree at MSU. The following year, with Kimberly Schlenker's guidance and support of the Gallatin National Forest, Karl worked full time and issued four advisories per week—the first year of the Southwest Montana Avalanche Center.

Overworked, Karl hired Ron Johnson part time in 1991 and then full time the following year. With the additional manpower, advisories were increased to six days a week. Given the Forest Service's financial commitment, the name was officially changed to the "Gallatin National Forest Avalanche Center" (GNFAC) in 1993.

Karl decided in 1994 to purse a doctorate from Arizona State University. During his fall absences, Alex Lowe and then Doug Chabot were hired intermittently to work with Ron. This continued until 1997 when Doug was hired part time allowing them to expand their advisories to 7 days a week.

The biggest change to the GNFAC occurred in 1999 when Karl was hired by the National Avalanche Center as an Avalanche Scientist and Technical Specialist. Doug moved to a full time position and then become the Director in 2000 with Scott Schmidt joining the Center as well. Scott worked full time in 2003, which allowed the Center to increase their education offerings and collection of field data.

The GNFAC has grown since its inception in 1990. During its first year of operation the Center's avalanche advisories were accessed 3,400 times; quite impressive given that it was a one-man, two phone line operation. This year the advisories were accessed over 176,000 times through our six phone lines, faxes, emails and web site. Additionally, we taught 60 education programs reaching 3,400 people.

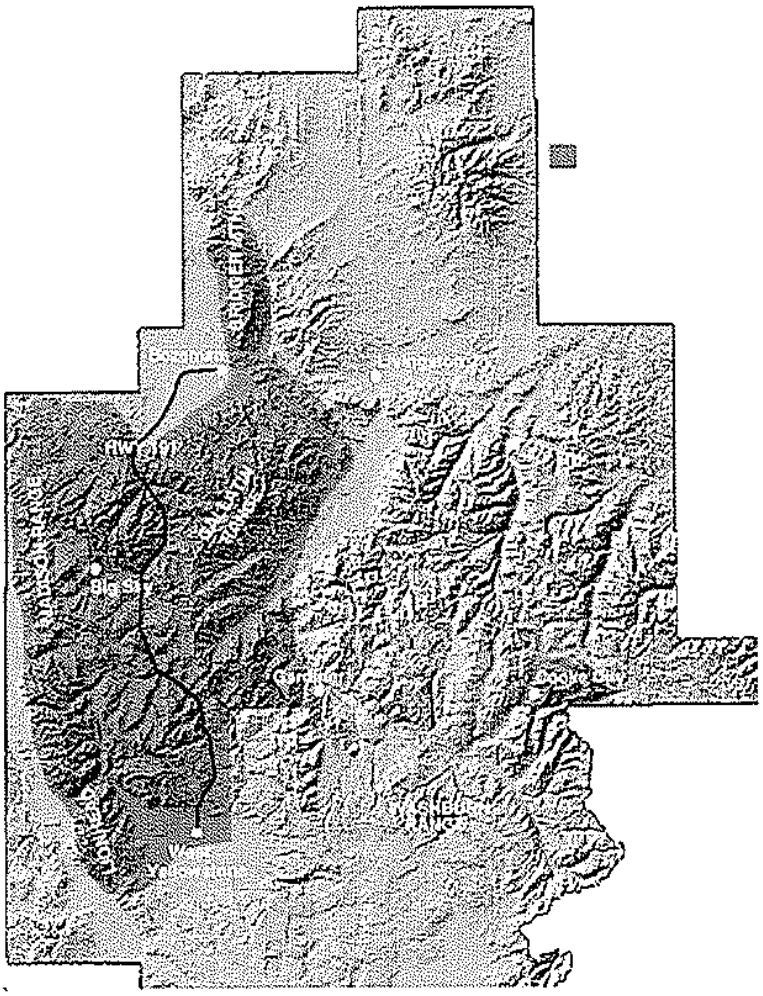
With winter recreation on the rise, we'll continue to meet the educational needs of our community. All of our partners contribute time, money and equipment that allow the GNFAC to fulfill its mission of providing high quality education and advisories to the public.

ADVISORY AREA

The Gallatin National Forest Avalanche Center covers over 10,000 sq. kilometers of National Forest land. Our specific area includes the:

- Bridger Mountains
- Gallatin Mountains
- Madison Range
- Washburn Range
- Mountains around Cooke City
- Lionhead area near West Yellowstone.

Our advisories cover very specific areas, and at times are broken into sub-groups to accurately describe the current avalanche conditions. Many people also extrapolate from our advisories for adjacent mountain ranges. The shaded areas on the map represent the approximate area covered by our advisories.



20 WAYS WE MADE A DIFFERENCE IN 2002-2003

This season we're proud to list many new accomplishments. We reached more people than ever before through our advisories and taught a record number of education classes. Every year our goal is to build upon the previous season, and this winter was very successful.

1. Our advisories were accessed 1,577 times a day through our email service, web page, phone lines and faxes. This is a 22% increase over last year and a 340% increase from 5 years ago.
2. We taught 60 avalanche education programs reaching 3,400 people.
3. Over 700 snowmobilers attended our lectures and classes this winter, almost doubling last year's outreach.
4. There was an unprecedented 5+ live recoveries this year of snowmobilers who carried and knew how to use avalanche beacons. It was satisfying to hear that some of those folks had attended our avalanche awareness classes. It's clear that avalanche education saves lives!
5. We secured more funding for Scott Schmidt, which allowed him to work full time this winter. His increased presence meant we were able to offer more education classes and get more field data.
6. We helped our Friends of the Avalanche Center spearhead the printing and distribution of 77,000 avalanche safety brochures targeting snowmobilers. The various avalanche centers funded this printing and these informative brochures will be handed out next winter.
7. We added a "glossary" function to our advisory web page. This allows an easy way get definitions of the many terms and danger ratings we use.
8. A new "Weekly Overview" page was added to our website. Ron updated this every Thursday recapping the previous seven days snowfall and avalanche activity.
9. Ron and Doug both lectured at the International Snow Science Workshop held in Penticton, BC, which was attended by over 600 avalanche professionals. Ron presented a paper titled "Integrating Shear Quality into Stability Test Results" and Doug spoke on "Avalanche Education for Snowmobilers".
10. Doug gave a one-hour lecture on Avalanche Awareness to a target audience of 100+ snowmobilers from around the country during a weekend rendezvous of mountain riders organized by Big Sky Extreme of Helena, MT.
11. We were able to increase our education offerings with the help of Chris Lundy. He taught 11 classes which gave us some breathing room since it's becoming increasingly difficult to meet the rising demand for our classes.
12. Our advisories are read more often than heard, so we continued our writing tutorial under the guidance of Sue Higgins. The Friends hired her to edit our advisories and improve our writing style.
13. David Lovejoy, a professor at Prescott College, "interned" (a very loose term given his credentials) with us during the month of January. He was a regular field partner and also helped teach some classes.
14. Every month we wrote articles relating to avalanches in the *Montana Snowmobile Association News* and *Carve*, a winter supplement to the *Bozeman Daily Chronicle*.
15. Our advisory was published every Wednesday in the Outdoor Section of the *Billings Gazette*.
16. The community became more involved in helping us get the avalanche gospel out. KGLT read an abbreviated advisory every morning, while KMMS continued to have a

live interview with Ron every Thursday, Friday and Saturday. Additionally, Danhof Chevrolet sponsored a weekly ad with the Avalanche Hotline number in the *Mini-Nickel*.

17. Polaris, along with a local snowmobile shop Team Bozeman, loaned the Friends two 800 RMKs for our use this winter. This allowed us to investigate avalanches which otherwise would've been inaccessible, and let us make personal contacts and educate hundreds of riders.
18. We were able to shotgun our message about avalanche safety with the help of the media. We had 22 media contacts that all resulted in favorable articles and television interviews.
19. We secured funding through the Friends of the Avalanche Center for the construction of two remote weather stations this summer. One will be located in the Lionhead area outside West Yellowstone, while the other will be erected outside Cooke City.
20. Jim Phelan of Big Sky Extreme filmed Doug for a segment in his upcoming avalanche awareness video.

ADVISORIES

Once again, we saw a rise in the number of people accessing our advisories. Our email subscription service and web site become more popular each year as computer technology gets better and easier to use. Our email list swelled to 1,071/day while hits to the advisory web page averaged close to 300/day. The phone lines now account for only 6% of our total accesses, or about 100 calls a day. Although the number of faxes we send out reached a plateau, many businesses still find it a popular way to receive the advisory.

In order to improve our advisories we continued to add photographs whenever possible. Pictures are powerful tools and can show an avalanche or the snowpack much more descriptively than words can. In addition to photos we added a pop-up glossary to our advisory web page. Created by web master Jim Earl, this program automatically highlights certain words that are linked to the glossary. Bruce Tremper was kind enough to let us use the definitions from his book "Staying Alive in Avalanche Terrain" as the template.

Back in the Dark Ages of the mid 90s, more people listened to our advisories than read them. This has drastically changed as Internet access and email became affordable and reliable. Currently 94% of the folks getting our advisories read them, which prompted us to become better writers. Or at least try to. Recognizing our shortcomings, the Friends hired Sue Gill to edit our advisories every week. Like a schoolteacher, her corrections and comments taught us proper punctuation, grammar and style that helped improve the quality of our advisories. We hope she'll continue this service next year since we've still got a long way to go.

Due to the lack of snow we had a delayed start to the season. We began issuing daily advisories December 23rd and continued through April 13th for a grand total of 111 advisories. Over the season these were accessed 176,690 times, averaging 1,577 people a day, which is a 22% increase over last year and a 340% rise since 1998-1999 (*Figure 1*).

The breakdown of the numbers are:

- 120,000 emails from our web based subscription service (1,071/day).
- 32,804 hits to our advisories web page www.mtavalanche/current/index.shtml (293/day).
- 11,203 phone calls to the Bozeman hotline, which services the Gallatin Valley, Livingston, West Yellowstone and Cooke City (100/day).

- 6,496 Forest Service internal emails (58/day).
- 4,256 faxes (38/day).
- 1,904 emails through the Cyberspace Snow and Avalanche Center www.csac.org (17/day)

Additionally, our home page (www.mtavalanche.com) received another 41,060 hits.

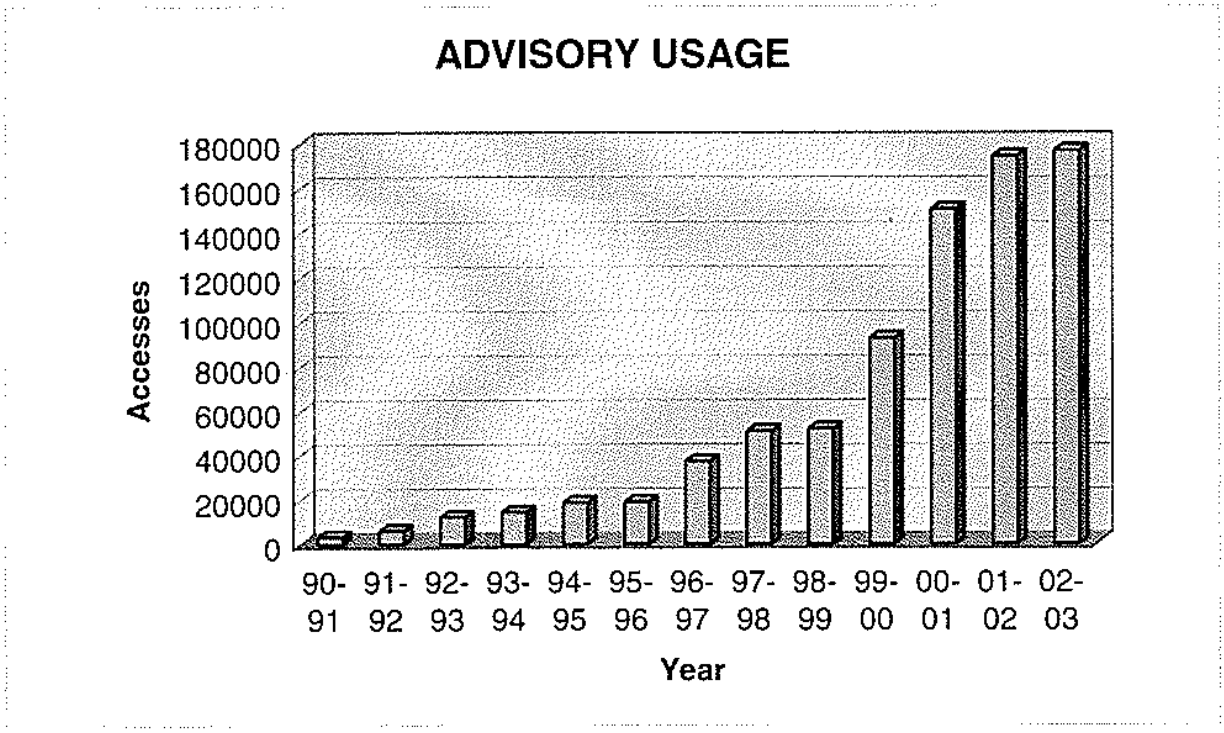


Figure 1: Advisory usage from 1990-91 to 2002-03

Our daily advisory, the showpiece of the Center, effectively implements our mission of helping people make good, safe decisions in the backcountry. Realizing the history of the snowpack is a valuable piece of the stability puzzle we made it easier for folks to get a handle on the avalanche conditions by adding a Weekly Overview section to our web site. These pages are updated every Thursday morning and recap the previous weeks weather and avalanche information. Ron worked very closely with Jeff Deems, an MSU graduate student, to create a weekly synopsis that is graphically displayed on the web. Items like snow water equivalency, temperatures and the corresponding avalanche danger rating are all compiled in charts, graphs and bulleted points.

AVALANCHE EDUCATION

Avalanche education is a major focus of our operation. Although our advisories are educational, we take it one step further by teaching formal classes on avalanche awareness, rescue, snow dynamics etc., to a wide audience. Most of our lectures are one to two hours long, but we're increasingly doing more all day classes and field sessions. All of these efforts paid off with the attendance of over 3,400 people at 60 different classes (*Table 1*).

Besides offering education in southwest Montana, we've been fortunate to spread our knowledge to other regions. We've taught snowmobile education across the state with classes in Lewistown, Missoula, Helena, and Lewis and Clark National Forest.

During peak times in December and January we were swamped with education requests that created scheduling conflicts. We were reluctant to miss a teaching opportunity so we had Chris Lundy, a master's graduate at MSU, ski patroller at Bridger Bowl, and springtime avalanche forecaster for Glacier National Park, teach 11 classes. He created breathing room in our schedule and we anticipate using him even more next year.

Cliff Gullet of Team Bozeman was once again extremely helpful in organizing our snowmobile class. He donated the use of his shop and helped advertise for the event. Additionally, Jeff Watt, owner of Ace Powder Guides in West Yellowstone, was instrumental in helping us organize and field assist the two-day Avalanche Awareness for Snowmobilers course. We ran two sessions and he provided participants with beacons, probes and shovels, he loaned us a snowmobile for the day, and he helped run the rescue drills as well as be the mechanic and tail gunner for moving our big groups.

Jim Phelan of Big Sky Extreme was also a huge advocate of our snowmobile education efforts. He is currently making a avalanche education film for riders which Doug assisted him on. Hopefully the video will be out by next winter.

Besides our classes, we try and educate folks by getting as much information into their hands as possible. Skiers and snowboarders have shelves of books to read about traveling safely in avalanche terrain, while snowmobilers lack basic material. Jill Fredston and Doug Fesler of the Alaska Mountain Safety Center wrote an 8-panel brochure on Avalanche Safety for snowmobilers funded by the AK Department of Natural Resources (see a copy on page 29). Recognizing that the need for this information extended beyond AK, they generously offered us a digital copy of the brochure so we could print up our own. Knowing that other avalanche centers would also be interested, our Friends of the Avalanche Center spearheaded the printing of 77,000 brochures for their distribution. This project was completed in April, so the brochures will be handed out at the start of next winter.

Some noteworthy education seminars included:

- The five-day International Snow Science Workshop held in Penticton, BC. Over 600 avalanche professionals attended from around the world.
- Advanced lectures on snow dynamics and rescue to the Bridger Bowl, Big Sky and Yellowstone Club ski patrols.
- An Avalanche Awareness lecture to all the 7th graders in Bozeman.
- Two weekend avalanche courses for snowmobilers held in Bozeman and West Yellowstone.

- Two multi-day Basic Avalanche Awareness Seminars and one Advanced Seminar taught through MSU.
- Workshops for the Big Sky, Gallatin County and Park County Search and Rescue groups.
- A lecture and field session for Forest Service Snow Rangers in Jackson, WY.
- Teaching two sessions on Avalanche Awareness and Rescue at the Regional Training academy in Missoula.

Table 1: **AVALANCHE EDUCATION**

DATE	INSTRUCTOR	GROUP	COURSE	#
29-Sep	Johnson	ISSW	Shear Quality	600
4-Oct	Chabot	ISSW	Snowmobile Ed	600
22-Oct	Chabot	Nat Ava Center	Snowmobile Ed	30
30-Oct	Chabot	Barrel Mountaineering	Transceivers	8
7-Nov	Chabot	Big Sky Snow Riders	Ava. Awareness	45
12-Nov	Chabot	Chief Joseph 7th Grade	Ava. Awareness	165
10-Nov	Johnson/Birkeland/Schmidt	Ski Patrols	Various Topics	50
13-Nov	Johnson	Nothern Lights Trading Co.	Ava. Awareness	37
14-Nov	Lundy	Dillon SAR	Ava. Awareness	30
19-Nov	Johnson	Sacajewea 7th Grade	Ava. Awareness	170
20-Nov	Johnson	Hebgen District	Ava. Awareness	15
20-Nov	Johnson	Big Sky Ski Patrol	Spatial Variability	50
21-Nov	Johnson	Lewis and Clark SAR	Ava. Awareness	37
21-Nov	Lundy	MSU Adventures	Ava. Awareness	25
3-Dec	Chabot	Beaverhead-Deerlodge NF	Ava. Awareness	25
4-Dec	Johnson/Birkeland	ASMSU	Basic Avalanche	140
5-Dec	Johnson/Birkeland	ASMSU	Basic Avalanche	120
5-Dec	Chabot/Johnson	Team Bozeman	Basic Avalanche	43
6-Dec	Schmidt/Johnson	Team Bozeman	Basic Avalanche	43
7-Dec	Schmidt/Johnson	ASMSU	Field Session	50
9-Dec	Lundy	Snowshoe Club	Ava. Awareness	12
10-Dec	Chabot	Yellowstone Club	SnowMetamorphism	20
10-Dec	Lundy/Johnson	Cooke City Community	Ava. Awareness	17
10-Dec	Schmidt	West Yellowstone SAR	Recent Avalanches	35
11-Dec	Lundy/Johnson	Cooke City Community	Field Session	10
14-Dec	Chabot/Lundy	West Yellowstone	Basic Avalanche	20
15-Dec	Chabot/Lundy/Schmidt	West Yellowstone	Field Session	20
17-Dec	Johnson	Yellowstone National Park	Ava. Awareness	18
5-Jan	Chabot/Schmidt	Team Bozeman	Field Session	35
7-Jan	Chabot	Gallatin Valley Snomo Assoc.	Ava. Awareness	35
9-Jan	Schmidt	Big Sky SAR	Ava. Awareness	25
11-Jan	Schmidt	Big Sky SAR	Rescue	25
12-Jan	Schmidt	Gallatin Co. SAR	Rescue	15
18-Jan	Johnson	Lewis and Clark NF	Ava. Awareness	40
20-Jan	Schmidt	Cooke City School	Ava. Awareness	8
21-Jan	Lundy	Boy Scouts	Ava. Awareness	21
25-Jan	Lundy	Big Sky Institute	Ava. Awareness	20

29-Jan	Johnson/Birkeland	ASMSU	Basic Avalanche	75
30-Jan	Johnson/Birkeland	ASMSU	Basic Avalanche	75
1-Feb	Johnson et. al.	ASMSU	Field Session	60
4-Feb	Lundy	Bridger Youth Empowerment	Ava. Awareness	11
4-Feb	Chabot	FS Snow Rangers	Field Session	31
4-Feb	Chabot	FS Snow Rangers	Ava. Awareness	12
5-Feb	Johnson/Birkeland	ASMSU	Advanced Avalanche	33
6-Feb	Johnson/Birkeland	ASMSU	Advanced Avalanche	33
8-Feb	Johnson/Birkeland/Schmidt	ASMSU	Field Session	33
10-Feb	Schmidt	Morning Star 5th Grade	Field Session	85
12-Feb	Chabot	MSU Snow Seminar	Season Summary	30
12-Feb	Johnson	Cooke City SAR	Ava. Awareness	30
15-Feb	Chabot	SnoWest Riders	Ava. Awareness	125
15-Feb	Schmidt	Winter Fair	Ava. Awareness	7
16-Feb	Chabot	Winter Fair	Ava. Awareness	12
20-Feb	Schmidt	Park County SAR	Ava. Awareness	60
4-Mar	Lundy	Morning Star 5th Grade	Beacons	29
25-Feb	Johnson	Lewis and Clark NF	Ava. Awareness	10
26-Mar	Chabot	Anderson School 7-8th Grade	Ava. Awareness	15
26-Mar	Schmidt	Regional Training Academy	Ava. Awareness	30
17-Apr	Chabot/Johnson	FS Law Enforcement	Ava. Awareness	6

TOTAL= 60 Talks/Seminars/Field Sessions to 3427 People

ACCIDENTS AND INCIDENTS

Unfortunately Montana had four fatalities this year, two of them in our advisory area and all of them snowmobilers. Nationally there were 30 fatalities, and 14 of them were snowmobilers. While four deaths is an improvement from ten last year and seven the year before, any fatality is one too many. This year we had long periods of unstable snow resulting in an unprecedented number of skiers and snowmobilers getting caught and buried. There were five instances reported to us of people using a transceiver to successfully dig out their partners. These easily could've been fatalities without the proper training and equipment.

Our education efforts are constantly being refined and we're always looking for new ways to teach. We love educating as many people as possible because knowledge is a powerful tool for staying alive. We're also excited about the live recoveries, especially since some of the rescuers were trained through the Forest Service. Evidence like this suggests that our education programs are effective at reducing fatalities. Consequently, we're aiming to teach even more people next season.

Table 2 represents all of the avalanche incidents and accidents reported to us. We only hear about a fraction of the avalanches actually triggered; yet with incidents involving injury and death we're usually notified quickly. As you look at the list you may notice that many of these incidents are clustered around certain dates. This should come as no surprise since these were usually preceded by significant snowfalls. The listings in **bold** are those that resulted in fatalities.

Table 3 lists all the avalanche fatalities this year in the US. As of June 10th there were 30 deaths: WY-7, CO-6, AK and MT-4 each, ID-3, NH-2, and UT, WA, NV, CA with 1 each.

Table 4 records the US avalanche fatalities for the last 17 years grouped by activity. This year was a bad one for snowmobilers with 14 deaths, four of them in MT. This group has the unfortunate distinction of leading all others in fatalities during this period. Given the popularity of the sport, the athleticism and youth of the riders, and the powerful machines, we are targeting our education efforts to try and stop this rising trend.

Table 2: AVALANCHE INCIDENTS & ACCIDENTS

DATE	LOCATION	DETAILS
19-Dec	Bridgers	1 skier triggered
22-Dec	Bridgers	1 skier caught, partially buried
22-Dec	Cooke City	1 snowmobiler caught, partially buried
28-Dec	Cooke City	2 snowmobilers caught, 1 fully buried, 1 partially buried
28-Dec	Cooke City	2 snowmobilers caught, 1 fully buried, 1 partially buried
29-Dec	Cooke City	1 snowmobiler caught, fully buried
5-Jan	Cooke City	1 snowmobiler caught, fully buried
7-Jan	Big Sky	1 patroller caught, not buried
13-Jan	Cooke City	3 snowmobilers caught, 2 fully buried, 1 partially buried
18-Jan	Mt. Ellis	1 skier triggered, not caught
18-Jan	Cooke City	1 snowmobiler caught, injured
19-Jan	Bridgers	1 skier triggered
20-Jan	TeePee Creek	1 snowmobiler triggered
22-Jan	Mt. Ellis	1 skier triggered
22-Jan	**Cooke City**	**1 snowmobiler caught, buried, killed**
23-Jan	Lionhead	multiple skier triggered
24-Jan	Big Sky	1 skier triggered
26-Jan	Bridgers	1 skier triggered
27-Jan	Bridgers	2 skier triggered, 1 caught
27-Jan	Beehive Basin	1 skier triggered
28-Jan	Bridgers	5 skier triggered, 3 caught
1-Feb	Cooke City	2 snowmobilers triggered, 1 partial, 1 complete burial
2-Feb	**Crazy Mtns.**	**1 snowmobiler caught, buried, killed**
2-Feb	Bridgers	3 snowboarders triggered
2-Feb	Lionhead	3 skier triggered
7-Feb	Cooke City	1 snowmobiler caught, partially buried
8-Feb	Mt. Wheeler	1 skier triggered
9-Feb	Taylor Fork	2 snowmobiler caught
12-Feb	Cooke City	2 snowmobiler caught
14-Feb	Bacon Rind	2 skiers caught
16-Feb	Bridgers	1 skier triggered
16-Feb	Beehive Basin	1 skier triggered
23-Feb	Big Sky	1 skier triggered
9-Mar	**Cooke City**	**2 snowmobilers caught, 1 fully buried, killed**
16-Mar	Tobacco Roots	2 skier triggered, 1 caught and buried
15-Mar	Cooke City	4 skier triggered
18-Mar	Lionhead	1 snowmobiler triggered
27-Mar	Bridgers	1 skier caught, fully buried
2-Apr	Big Sky	1 skier caught
3-Apr	Big Sky	1 skier caught

TOTAL= 40 Incidents resulting in 19 burials, 1 injury and 3 deaths

Table 3: 2002-03 US AVALANCHE FATALITIES

DATE	LOCATION	STATE	DETAILS
26-Apr	Blue Lakes	CA	1 snowmobiler buried and killed
14-Apr	Devils Thumb	AK	2 climbers killed
9-Apr	Wrangell-St. Elias NP	AK	1 backcountry skier buried and killed
22-Mar	Burro Peak	CO	1 snowmobiler buried and killed
20-Mar	Loveland Pass	CO	1 out-of-area skier killed
9-Mar	Cooke City	MT	1 snowmobiler buried and killed
9-Mar	Sawatch Range	CO	1 snowmobiler buried and killed
5-Mar	Sawatch Range	CO	1 snowmobiler buried and killed
24-Feb	Afton	WY	1 snowmobiler buried and killed
23-Feb	Sawatch Range	CO	1 backcountry skier buried and killed
22-Feb	Selkirk Mtns.	ID	1 backcountry skier buried and killed
22-Feb	Selkirk Mtns.	ID	1 snowmobiler buried and killed
17-Feb	Loveland Pass	CO	1 climber buried and killed
15-Feb	Big Cottonwood	UT	1 backcountry skier buried and killed
10-Feb	Jackson	WY	1 out-of-area skier killed
9-Feb	Hatcher Pass	AK	1 backcountry snowboarder killed
2-Feb	Crazy Mtns	MT	1 snowmobiler buried and killed
1-Feb	Lincoln	MT	1 snowmobiler buried and killed
28-Jan	Teton Pass	WY	1 backcountry snowboarder killed
25-Jan	Tewogotee Pass	WY	1 snowmobiler buried and killed
22-Jan	Cooke City	MT	1 snowmobiler buried and killed
5-Jan	Sheep Pass	WY	1 snowmobiler buried and killed
4-Jan	Teton Pass	WY	1 backcountry snowboarder killed
29-Dec	Crystal Mt.	WA	1 backcountry skier buried and killed
28-Dec	Trinity Mtns.	ID	1 snowmobiler buried and killed
26-Dec	Snowy Range	WY	1 snowmobiler buried and killed
15-Dec	Mt. Rose	NV	1 out-of-area snowboarder killed
30-Nov	Mt. Washington	NH	2 climbers killed

TOTAL= 30 FATALITIES (as of 6-10-03)

Table:4 US AVALANCHE FATALITIES BY ACTIVITY

ACTIVITY	86-87	87-88	88-89	89-90	90-91	91-92	92-93	93-94	94-95	95-96	96-97	97-98	98-99	99-00	00-01	01 02	02 03	**17-winter totals**
climbers	6	2	0	0	3	7	3	2	6	9	6	3	1	0	2	0	5	**55**
BC skiers*	2	6	2	2	2	7	9	2	7	6	0	0	3	8	5	6	5	**72**
in-area skiers/riders	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	**1**
OB skiers*	8	0	2	3	0	4	5	0	0	1	0	1	2	5	5	1	2	**39**
BC snowboaders	0	0	0	1	0	0	2	0	1	3	1	4	4	0	2	0	3	**21**
OB snowboaders	0	0	0	0	0	0	1	0	2	1	0	0	3	1	0	4	1	**13**
snowmobilers	2	0	0	1	2	2	2	9	7	5	6	14	13	5	15	18	14	**115**
misc. recreation	3	0	0	1	1	2	4	0	1	2	7	4	4	1	4	3	0	**37**
patrollers	0	0	1	0	0	0	1	0	1	1	0	0	0	0	0	0	0	**4**
motorists/highway workers	0	0	0	0	0	1	1	0	1	0	0	0	0	1	0	0	0	**4**
residents	0	0	1	0	0	0	0	0	2	1	0	0	0	1	0	0	0	**5**
others @ work	0	0	0	0	0	1	1	0	0	1	2	0	1	0	0	0	0	**6**
total	**21**	**8**	**6**	**8**	**8**	**24**	**29**	**13**	**28**	**30**	**22**	**26**	**32**	**22**	**33**	**32**	**30**	**382**

*BC= backcountry OB= out-of-bounds

This table was compiled by the Colorado Avalanche Information Center.

MEDIA

A spike of media interest always follows avalanche accidents and fatalities. Although accidents are unfortunate, the ensuing press coverage provided us with great opportunities to inform the public about avalanche danger. Our 22 media contacts (*Table 5*) resulted in favorable articles and television spots that piqued the public's interest in avalanche education, and increased the demand and attendance of our classes. Copies of the various newspaper and magazine articles begin on page 51.

This was our second year working with KMMS (95.1 FM) radio. Once again, every Thursday, Friday and Saturday Ron would have a 2-minute spot highlighting avalanche conditions. Additionally, KGLT (90.1 FM) started reading an abbreviated advisory on the air every morning. Between the two stations we reached a large segment of the local population. Our advisory hotline number was also displayed in an ad every week in the *Mini-Nickel*. Danhof Chevrolet donated that space and we appreciate the support.

Some highlights of the coverage we received included:

- An editorial and cover story in the *Bozeman Daily Chronicle*. The editorials were flattering about the positive effects the GNFAC has on the community.
- A front-page story in the *Livingston Enterprise*.
- An article in *Outside Bozeman*.
- An article in *National Geographic Adventurer*.
- The Montana Snowmobile Association ran a free ad in every issue for all the Montana avalanche center's hotlines and web sites.

Table 5: Media Contacts

DATE	STAFF	AGENCY	TOPIC
10-Oct	Chabot	National Geographic	Fact checking
15-Oct	Chabot	Outside Bozeman	Avalanches
17-Oct	Chabot	TBS	Avalanche incidents
6-Nov	Chabot	Bozeman Chronicle	General GNFAC facts
11-Dec	Chabot	Couloir Mag	Snow Pilot project
11-Dec	Chabot	Bozeman Chronicle	Avalanche education
12-Dec	Johnson	Bozeman Chronicle	Avalanche danger
16-Dec	Chabot	West Yell Enterprise	Avalanche class
26-Dec	Chabot	Couloir Mag	Snow Pilot project
27-Dec	Johnson	ABC	Avalanche warnings
27-Dec	Johnson	Helena Independent Record	Avalanche warnings
30-Dec	Johnson	Livingston Enterprise	Avalanche warnings
30-Dec	Schmidt	NBC	Avalanche warnings
30-Dec	Schmidt	KBZK TV	Avalanche warnings
30-Dec	Schmidt	Bozeman Chronicle	Avalanche warnings
27-Jan	Chabot	KBZK TV	Avalanche danger
30-Jan	Chabot	Billings Gazette	Avalanche danger
4-Feb	Schmidt	KBZK TV	Avalanche danger
4-Feb	Schmidt	Bozeman Chronicle	Avalanche danger
5-Feb	Johnson	Bozeman Chronicle	Avalanche danger
21-Feb	Johnson	Independent filmaker	Avalanche awareness
13-Mar	Chabot	KULR-8	Avalanche safety

TOTAL= 22 CONTACTS

PROFESSIONAL DEVELOPMENT

Most of our energy is spent teaching locally, however, we occasionally are invited to lecture outside of Montana. It's impossible to accept every invitation, but we like to broaden our horizons and avoid the dangerous pitfall of tunnel vision by taking opportunities to teach in different areas. One way we keep ourselves flexible and open to new developments in snow science is by traveling around and interacting with other avalanche professionals.

Highlights included:

- Ron and Doug lectured at the International Snow Science Workshop. Their papers on stability tests and snowmobile education can be viewed online at www.mtavalanche.com/articles/index.shtml .
- At the National Avalanche Center's annual meeting in Sun Valley, ID, Doug lectured on how the GNFAC educates snowmobilers and also outlined the development of the Snow Pilot project (see page 20).
- Doug went to Jackson, WY, to speak to the Forest Service Snow Rangers about snowmobile education. He talked about avalanche awareness, and more specifically, on how avalanche education for snowmobilers is evolving.
- Scott taught two sessions at the Regional 1 Training Academy in Missoula on Avalanche Awareness and Rescue. Forest Service personnel throughout Montana and Idaho participated.

ARTICLES

Besides writing the daily advisories, we occasionally pen articles for local and national media. Some of the articles we wrote were for specific user groups while others were for the general public.

Some articles included:

- Scott wrote an article summarizing the avalanche season for the trade journal *The Avalanche Review.*
- Also in the *Avalanche Review,* Ron wrote about the "Perfect Avalanche" and I wrote a piece on the progress of our Snow Pilot project.
- Ron and Scott both wrote articles for snowmobilers every month in the *Montana Snowmobile Association Newsletter.*
- Ron co-authored with Lance Riek an article in *Couloir Magazine* on "Safe Travel in Avalanche Terrain".
- Ron wrote a piece on Avalanche Rescue for the *Wilder News*, a newsletter of the Wilderness Medical Association.
- Doug authored seven articles on avalanche safety in his "Snow Advisory" column in the monthly *Carve* magazine published by the *Bozeman Daily Chronicle.*
- Doug wrote a piece on wet avalanches for the spring issue of *Outside Bozeman.*

Copies of these articles are included at the end of the report in the "Newspaper and Magazine Articles" section starting on page 51.

FINANCES AND FUND RAISING

The GNFAC continues to get strong support within the Forest Service. The Gallatin National Forest funds one full time position, plus all of the expenses associated with operating an avalanche center (vehicles, office space and supplies, etc), which total over $60,000. Our budgetary shortfall is covered by the generosity of many agencies, businesses and individuals.

Friends of the Avalanche Center
These dedicated volunteers are our safety net. This year they donated $7,176 that covered our snowmobile expenses in addition to administrative and field supplies. Page 18 outlines their efforts in detail.

Montana Fish, Wildlife and Parks Recreation Trails Grant
Bob Walker and Steve Gilbert are strong advocates of the state avalanche program and we were given $11,000 for our operation. We successfully competed for money again this year, which will be used for next winter's operation.

Region 1 Earmark
Gary Morrison, director of recreation in Region 1, pushed through an earmark of $20,000 to help us with our shortfall for the second year in a row. This represents a significant portion of our budget. We greatly appreciate his support, especially since this money kept our head above water.

Gallatin County Search and Rescue
Gallatin County Search and Rescue has been one of our most steadfast supporters with donations of $4,000 every year. Our partnership with them is invaluable and the steady funds we receive go a long way towards the success of our operation.

Montana Fish, Wildlife and Parks Snowmobile Safety Fund
Ray Paige of FW&P is in charge of the state snowmobile safety program and was very generous by donating another $3,000 again this year. FW&P have been supporters of the Avalanche Center since its inception, and we appreciate their continued support.

Greater Yellowstone Coordinating Committee
The GYCC awarded a $3,000 grant to the GNFAC to continue our education efforts. We are very thankful to receive this money, especially since it came at the end of the year when our budget tends to be the tightest.

CONTRIBUTIONS OF LABOR AND EQUIPMENT

The GNFAC owes its success to a community wide effort. Our support network includes corresponding agencies, businesses, and people who volunteer their time or call in observations. We estimate the value of all the donated time exceeds $14,000. Certainly without this group of volunteers we would not be able to operate in our current capacity. A host of "unofficial" volunteers called in observations on a regular basis. Given that we're information starved many days, we appreciate all the calls and emails we get about current snow conditions. Over 60 individuals fall into this category including the combined efforts of Bridger Bowl Ski Area, Big Sky Ski Area, the Yellowstone Club, Ace Powder Guides, and Cooke City Sinclair for their great website on local snow conditions. Besides volunteer labor, we're fortunate that many companies have donated gear and supplies.

Some "official" agencies and businesses include the National Weather Service, The Natural Resources Conservation Service (NRCS), the Forest Service offices in West Yellowstone, Bozeman and Gardiner, and the National Park Service offices in Canyon and the Northeast Gate. We also owe a big thanks to Forest Service employees Larry McKee and Drew Morrill for their steadfast observations around Cooke City.

On most days of the week one of us can be expected to be outside gathering data for the next days advisory. With our small staff it's difficult to always get out amongst ourselves, so we rely on a group of volunteers to go out in the field with us. This year Ed Adams, Seth Adams, Conrad Anker, Karl Birkeland, Jeff Deems, Stuart Dominick, Randy Elliot, Marty Faulkner, Scott Gill, Cliff Gullett, Dale Gullett, Jeff Hollenbach, Fay Johnson, Kathy Kinser, Erik Knoff, Spencer Logan, David Lovejoy, Chris Lundy, Pete Maleski, Beth McConnell, Ladean McKittrick, Brian McNeil, Molly Merica, Ron Nabor, Alan Oram, Jay Pape, Lance Riek, Bob Siebert, Drew Seessel, RA Schmidt, and Jeannie Wall, took time to safely accompany us in the field, even during marginal skiing conditions.

Matt Vandzura is a ranger out of Canyon in Yellowstone National Park. He feeds us crucial snowpack observations about the Washburn Range, which get incorporated into our advisories.

Jim Earl deserves a special mention for all his work on our web site. He created our glossary and helped Jeff Deems and Ron with the Weekly Overview pages. Additionally he was able to troubleshoot problems as they arose, promptly fixing and tweaking the mysterious codes of the Internet to keep our site running.

Northern Lights Trading Company
This local store has been supporting the Avalanche Center since its inception. They generously loan all of us top of the line skis and boots for the winter.

Jeff Deems worked tirelessly creating the template for the Weekly Overview pages. He volunteered dozens of hours on its creation. His accomplishment speaks for itself and we all owe him big thanks for taking on this project.

David Lovejoy, a professor at Prescott College, volunteered for a month as an intern with us. Doug was a student of David's in the mid 80's, so "interning" is a misnomer. His field expertise and insights into the snowpack were greatly appreciated, and he's one of the most competent field partners any of us have skied with. We all felt very lucky to have him be a part of the GNFAC and were sad to see him go.

FRIENDS OF THE AVALANCHE CENTER

The Board of Directors include:
Molly Merica (President), Drew Seessel Chas Day, Jeannie Wall, Greg Caracciolo, Laura Nauman, Dale Sexton, Jeff Deems, Chris Lundy, Annie Fast, Jay Pape, Lance Riek, Marty Faulkner, and Cliff Gullett.

As our biggest supporters, the Friends of the Avalanche Center continue to be a cornerstone of our program. They began the year organizing the third annual Powder Blast fundraiser that netted over $8,800. Nike ACG came on board as the primary sponsor of that event and helped kick off the party with their $2000 donation. The entire Board rallied around this fundraiser, which was a huge success. We are indebted to these dynamic and hard working individuals for all their time and energy they put into helping the Avalanche Center.

This year the Friends gave us $7,176 in support by paying for many expenses incurred outside of our normal operations. The snowmobiles that are donated by Polaris require general maintenance, oil, insurance, covers, as well as replacing bent trailing arms and tie rods from pretending to better riders than we actually were! If you own a sled you know how quickly these costs can add up.

The Friends also covered many administrative expenses, which included the fees to our email provider, Internet server, CDs, software, and subscriptions. They also paid for the design and printing of magnets and stickers for our education programs. Additionally, they paid Sue Gill for her professional editing services and compensated Chris Lundy for his teaching time.

Besides the wildly successful Powder Blast, a few other fund-raising events deserve special mention.

Surfrider Foundation and the Friends hosted a showing of the new Teton Gravity Research film "The Prophecy". They split the proceeds, which netted the Friends over $1,700.

Frozen Earth Film Festival donated $500 to the Friends.

Doug Stoup, and Kris Erickson showed a film on Antarctica featuring Hans Saari that was produced by The North Face. They donated proceeds from the door and silent auction to the Hans Saari Memorial Fund. This boosted the amount in the fund by $2,952!

Bridger Bowl, a supporter of the Avalanche Center since its inception, sponsored a race with **Dick Walter Motors** entitled "King and Queen of the Ridge". Participants got pledges on the vertical distance they hiked and skied. It was a huge success and Bridger donated $3,800 to the Friends.

The Friends, being a non-profit 501 3 (c) organization, provide a means for other individuals and organizations to financially support avalanche education and information. These community partnerships are invaluable since the support we get reaches far into the fabric of southwest Montana. This aspect of the Friends is understated, yet an important part of their overall mission. This year they received support from:

Hans Saari Memorial Fund
Hans Saari was tragically killed in a skiing accident in France in 2001. His untimely death was felt throughout the Bozeman community, home to his family and many friends, as well as the larger international skiing and climbing community. Donations sent to the Friends in his memory will be used to fund avalanche education through annual draws of interest allowing the principal to be maintained in perpetuity. This year the Friends used $800 to pay Chris Lundy to teach 11 courses that reached 215 people. As the Fund grows we'll have even more money for education.

Drew and Jennifer Seessel
Drew and Jennifer, avid backcountry skiers and supporters of the Avalanche Center, made a substantial donation to the Hans Saari Memorial Fund. We all appreciate their generosity.

Nike ACG helped the Friends out by being the primary sponsor of the Powder Blast. They donated $2000 for the event, which gave the Friends a huge jumpstart in organizing the event.

Polaris and Team Bozeman
Cliff Gullett, owner of Team Bozeman, once again worked with Polaris and the Friends to loan us two snowmobiles for the winter. Polaris, for the third year in a row, gave us two new sleds to ride. This year we rode the 2003 800-RMK, 151" track. Talk about power! Given the number of snowmobilers in our advisory area, these machines have been instrumental in getting us to areas that were previously inaccessible. Equally important, these sleds allowed us to encounter and educate riders on a regular basis. Team Bozeman also donated prizes to the Powder Blast and gave us valuable advice about snowmobiling. He also discounted parts, repairs and warranties worth over $1,500. Furthermore, they sponsored the KMMS live interview with Ron three days a week discussing the avalanche conditions.

Montana Telemark Corporation
They hosted the Pinhead Classic, a telemark event held every year at Bridger Bowl. A record $1,300 in proceeds was donated to the Friends. We appreciate the hard work that Warren Bauder and other volunteers did organizing this fantastic event.

Merica Design
Molly Merica, president of the Friends, was invaluable in her commitment to raise money for the Avalanche Center. She donated over $1,000 in time designing posters, logos, placemats, and stickers, and provided leadership to the board of directors.

Backcountry Access awarded the Friends $950 to go towards funding our education efforts. In addition to this cash donation they included two Tracker avalanche transceivers and a flux line graph for our field classes. They are avid supporters of avalanche education throughout the country and we grateful to the donation they made to the Friends.

Big Sky Ski Patrol
The Ski Patrol generously donated $500 from the proceeds of their Dirt Bag Ball.

Snow Pilot: Using PDAs to Collect and Share Snowpit Data

(This is an article Doug wrote for the spring issue of *The Avalanche Review.*)

The idea of using Personal Digital Assistants (PDAs) to collect snowpit data isn't new. Ever since they arrived on the scene a few years ago people started to envision using them as tools in the field, which has been done successfully in other branches of science. However, the main stumbling block to creating a program for avalanche professionals was always money. We knew the brainpower existed to write the software, but it was cost prohibitive. This all changed last fall when Conrad Anker, working with our Friends of the Avalanche Center, secured a grant from the Omega Foundation to hire a programmer to write snowpit data collection software. In addition to this grant, the Friends also received a donation of 75 PDAs from Handspring that we'll hand out to avalanche centers, researchers and other snow professionals once the development is completed. The project was launched last fall and has been in development last winter; we're currently in the process of testing the fourth version and with a little more beta testing it will be ready this summer. The official launch of the program won't occur until next fall since we want it to coincide with the start of the avalanche season. Best of all, the program will be downloadable for free off of our web site www.snowpilot.org, hosted by avalanche.org.

Let's face it, standing in a snowpit and writing in your notebook, especially in adverse weather conditions, is slow, tedious, and cold! Further, once the data have been scribbled into a pit book and possibly rewritten a second time back at the office, there's no simple way to share this difficult-to-collect information with other avalanche centers, researchers or with the public. In addition, any scientific analysis of these data is difficult or impossible.

Snow Pilot will provide an easy, fast, and standardized way to collect snowpit data, and have the additional advantage of providing researchers with a way to seamlessly share this information. It will bring the recording of field observations, snowpits and stability tests into the digital age, where instead of islands of disparate paper records, there would be a vast uniform database for all to share.

This robust scientific data collection system will allow avalanche forecasters and snow scientists to utilize a PDA to easily record snowpit information. Drop down menus and "point and click" entries will allow for rapid data collection and field validation. In the field, the user will be able to beam snowpit information to other PDAs, allowing real-time sharing. Once in the office, the data will be seamlessly synched to the user's PC where information will be compiled into a snowpit profile. These profiles can also be posted on websites to provide the public with additional snowpack information. While this application is a new and innovative way to collect data, the real beauty of the program is that all the information will be sent off to a centralized

database at avalanche.org. Once in the database, these records will be instantly available to researchers and forecasters via the Internet.

I have high hopes for this project. I'm tired of rifling through my pit books, hand-scribing data for different research projects. And I certainly won't miss redrawing my snowpits once I get back to the office. The program will also allow you to set preferences for different users. Do you like zero at the top of your pit rather than at the bottom? Do you use Fahrenheit instead of Celsius; measure in inches instead of centimeters? No problem, it can accommodate you.

Stay tuned for the official release fall 03. We'll soon be standing in snowpits beaming each other.

BUDGET

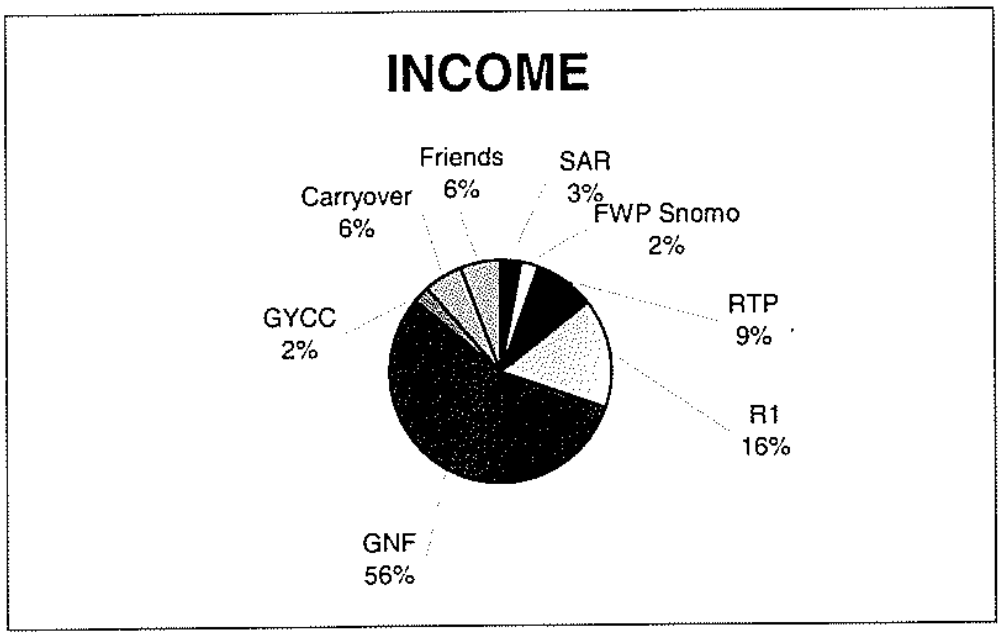
INCOME

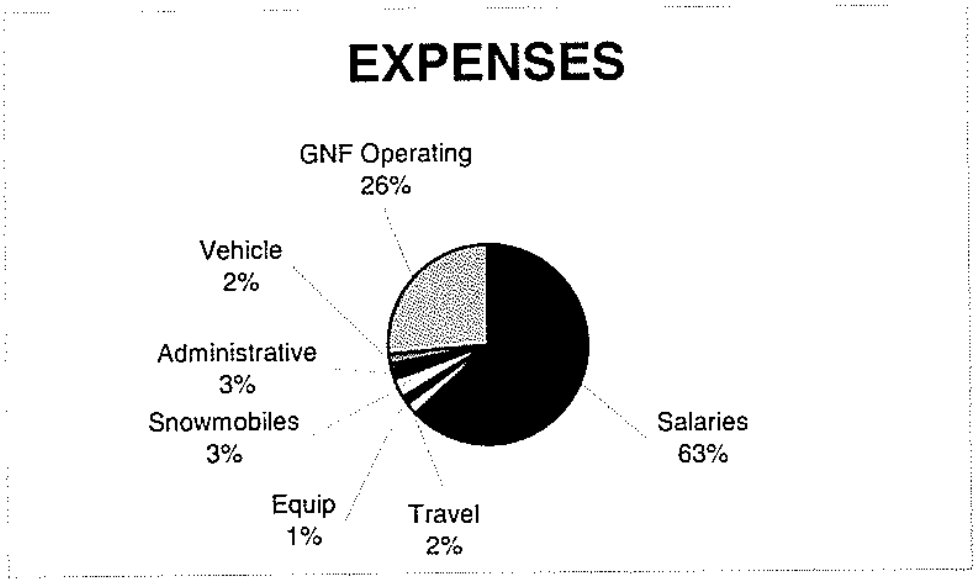
Montana FW&P Rec. Trails Program	$11,000	
Region 1 Earmark	$20,000	
Gallatin County Search and Rescue	$4,000	
Friends of the Avalanche Center	$7,176	
Montana FW&P Snowmobile Safety	$3,000	
GYCC Grant	$3,000	
TOTAL CASH CONTRIBUTIONS		$ 48,176
TOTAL GALLATIN NATIONAL FOREST CONTRIBUTION		$70,420
CARRYOVER from 2001-2002		$7,185
TOTAL INCOME		$125,781

EXPENSES

Salaries	$78,302	
GNF operating costs[1]	$32,760	
Travel/Training	$2,500	
Misc. Equipment[2]	$1,635	
Snowmobiles equip/maintenance[3]	$3,894	
Administrative costs[4]	$3,282	
Vehicle	$1,960	
TOTAL EXPENSES		<$124,333>
EXPECTED CARRYOVER		$1,448

[1] The operating costs incurred by the Gallatin National Forest include office space, supplies, mailings, computers, support personnel, six phone lines, sat/cell phones, and 19.5% overhead for grants.
[2] Misc. equipment expenses the Gallatin NF incurred included: Snowmobile trailer, hitch, equipment repair, film, uniforms, etc.
[3] The Friends of the Avalanche Center paid for these expenses: Insurance, oil, delivery charges, covers, and trailer repairs.
[4] The Friends of the Avalanche Center paid for these expenses: Beacons, software, teaching materials, dataloggers, and educational handouts.

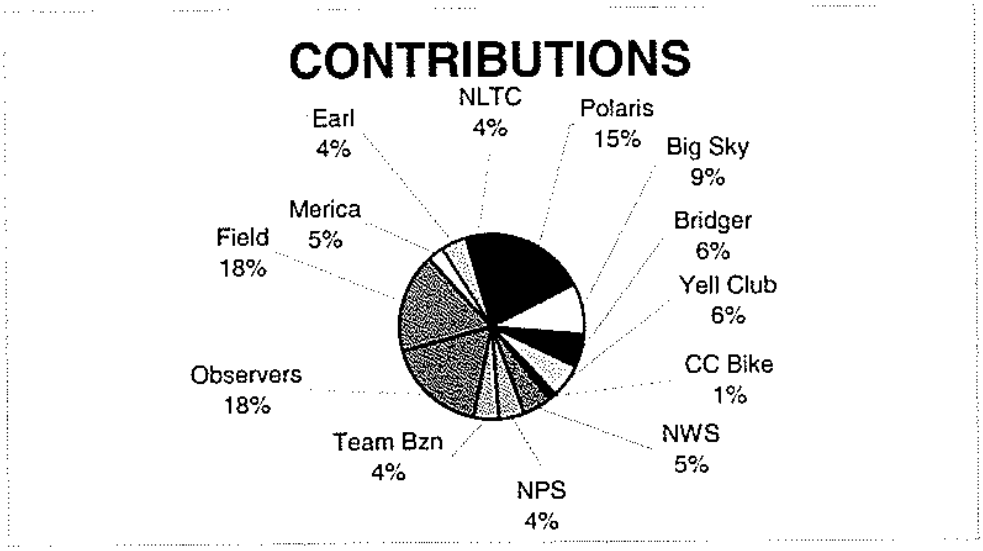

INCOME
Friends 6%
SAR 3%
Carryover 6%
FWP Snomo 2%
RTP 9%
GYCC 2%
R1 16%
GNF 56%


EXPENSES
GNF Operating 26%
Vehicle 2%
Administrative 3%
Snowmobiles 3%
Equip 1%
Travel 2%
Salaries 63%

DONATED LABOR AND EQUIPMENT

In addition to cash contributions, the GNFAC also relies heavily on $34,200 in donated equipment and labor. The labor donations represent a dollar estimate of what it would cost to hire people to collect the information that these business and agencies provide. It's clear that without these donations the Avalanche Center would be unable to operate at its current level.

Equipment:	
Polaris Industries (2 loaner snowmobiles)	$6,000
Northern Lights Trading Company	$1,500
Labor:	
Jim Earl Web Design	$1,000
Big Sky Ski Area	$3,000
Bridger Bowl Ski Area	$2,000
Yellowstone Club	$2,000
Cooke City Bike Shack	$500
National Weather Service	$1,700
National Park Service	$1,500
Team Bozeman	$1,500
Volunteer observers and office help	$6,000
Field volunteers (600+ hours)	$6,500
Merica Design	$1,000
Computer Programming	$1,000
TOTAL	$34,200



SEASON SNOWFALL HISTORY

By Scott Schmidt

This winter was one of the more interesting avalanche seasons since the start of the Gallatin National Forest Avalanche Center. Very little snow fell in our advisory area during the month of October, and what little snow was on the ground was subject to a prolonged period of very cold temperatures at the end of the month. This resulted in 8 to12 inches of well-developed facets throughout our entire region. November continued to be dry, and temperatures remained cold enough to preserve these facets at higher elevations. The most notable event during this period was unusually warm temperatures on the 21st of November. Cold temperatures followed, forming the "Thanksgiving" ice crust that set the stage for the rest of our season.

December was dry for the first part of the month and a layer of faceted crystals developed on top of the Thanksgiving crust. The only significant snowfall during the early part of the month occurred in the south, around Cooke City and West Yellowstone. The northern areas began to get some snow near the middle of the month with enough accumulation to produce the first reported avalanche burial on the 22nd. A moist southwest flow deposited 3 inches of water in the southern mountains over a 3-day period starting on the 28th, and was accompanied by 3 full, and 2 partial burials in the mountains north of Cooke City. This avalanche cycle ran on the crust near the ground, eliminating this layer on many slopes.

The storm cycle continued into the early part of January, with the southern mountains getting snow continuously until the 6th. A well-developed surface hoar layer formed in the southern mountains during a 6-day period of clear weather. New snow, starting on the 12th, brought on another rash of human triggered avalanches in the Cooke City area, with 6 more full burials by the 18th. The last of these burials resulted in a snowmobiler being seriously head injured and hospitalized. The first fatality of the season occurred on the 22nd when a snowmobiler was buried in a small slide. Even though he was wearing a beacon and extracted quickly, rescuers were unable to revive him. This avalanche was part of a large cycle that ran on the surface hoar layer formed a few weeks prior.

January went out as it came in, with significant snow in the southern mountains every day from January 23rd to February 4th. These storms deposited up to 8.5 inches of water resulting in 10 days of consecutive avalanche warnings, the longest warning period in the center's history. Because of the excessive amount of snow, several lower angle slopes that had not previously run, triggered on the surface hoar, and several avalanche stepped down to the ground. The largest of these was a climax avalanche that ran the full length of Henderson Mountain, nearly one mile in length. The northern areas also received snow during this period and, given the unstable snowpack throughout our region, we received reports of human triggered avalanches nearly every day from the 18th of January to the 12th of February.

The storm pattern turned around in February and now it was the northern mountains that were receiving record snowfall. Large, but isolated, natural and human triggered avalanches were reported with each storm, but in wasn't until the 17th that enough load accumulated to produce a widespread cycle that ran on the Thanksgiving crust. Outside our advisory area a second fatality in the Crazy Mountains was followed by a third outside Lincoln Montana on the Helena National Forest. Both of these occurred in early February and were a reminder of the continued instability that was prevalent in our snowpack. Record snowfall continued throughout our region into March and unfortunately resulted in the 4th, and final, Montana avalanche fatality on the 9th near Cooke City. Due in part to the large number of natural avalanches, and strengthening of

several weak layers, many paths were finally starting to stabilize. Reports of human triggered avalanche became more sporadic, with the last reported burial on March 29th and the last reported human triggered slide on April 11th. Despite the record low snowpack early in the season, Southwest Montana ends the winter season with above average water in all but a few drainages.

FUTURE PLANS

In order to continue improving the Avalanche Center we put together a Strategic Plan outlining short and long-term goals. As stated at the beginning of the report under "20 Ways We Made A Difference", we had a very successful year and accomplished all of our short-term goals and many of our long-term ones. We're already starting to think about next year and have a list of goals we hope to accomplish. Obviously these are dependent on money and personnel, both of which we hope to have enough of. Our future goals include:

- The operation of two new remote weather stations located in the mountains around Cooke City and the Lionhead area outside West Yellowstone. While we get good snowfall and temperature data near these areas, these mountains lack wind measurements. We've always extrapolated and made educated guesses about what the wind was doing, but now we'll have hard evidence that will make our advisories more accurate. The Friends of the Avalanche Center are funding the purchase and installation of these instruments.

- We want to have the Snow Pilot project fully operational next winter.

- We will continue with the expansion of our snowmobile education program and plan to offer more education in the West Yellowstone area, for both the public and guides, as well as continue our programs in Bozeman.

- Chris Lundy will hopefully be able to continue teaching for us when our schedule gets too tight. We'd like to offer more classes using outside personnel so we can reach everyone who requests a program.

- Our fingers are crossed that Sue Gill will edit our advisories again next year since we need to keep improving our writing.

- As always, we're still searching for new and consistent funding sources.

Everyone that's helped us reach our past goals deserve many thanks! With your help, we'll continue to provide high quality avalanche education and information.

EXAMPLE OF AN AVALANCHE ADVISORY

Internet: www.mtavalanche.com

Gallatin National Forest Avalanche Advisory

Recorded Information:
Bozeman, Livingston,
West Yellowstone, Cooke City:
406-587-6981
Office: 406-587-6984

WEDNESDAY, MARCH 26, 2003

Good morning, this is Doug Chabot with your Gallatin National Forest Avalanche Advisory issued on Wednesday, March 26th, at 7:30 am. The **Friends of the Avalanche Center** and the **Hans Saari Memorial Fund** are the sponsors of today's advisory, which does not apply to the local ski areas.

WEATHER

A swath of moisture extending to the coast laid down some new snow last night; 2-3 inches fell in the northern mountains while 4-6 inches fell from Big Sky to West Yellowstone. The mountains around Cooke City got double this amount with over a foot at the higher elevations. Temperatures have been in the twenties as winds blew from the southwest at 15-30 mph. Today and tonight we'll continue to be fed moist, unstable air. The brunt of this fast moving system will be to the south of us and I'm expecting another 8-12 inches down south tapering off to 4-6 inches in out northern mountains. Winds will continue to blow steadily at 15-20 mph from the southwest today, but will switch to a more northwest direction tonight.

SNOWPACK AND AVALANCHE DISCUSSION

The Bridger, Madison and Gallatin Ranges and the Lionhead area around West Yellowstone

The Bridgers and northern Gallatins got freshened with 2-3 inches last night while the rest of the Gallatin and Madison Ranges, including the Lionhead area, got closer to 6 inches. The snow water equivalency totaled only ½ an inch, which isn't much of a load. Certainly near ridgetops this load would be greater from wind-drifted snow, and in these areas you could probably trigger a slide.

I was down riding in the Lionhead area yesterday and didn't see any new dry snow avalanches since I was there a week ago. I dug some pits and was pretty excited about how the snow gained strength in the last eight days. It was the most dramatic change for the good I've seen down there this year. Some lingering instabilities, like the surface hoar layer about three feet under, are finally becoming less of an issue. And the weak layer of facets that was responsible for the avalanche activity last week has lost its snap; my tests and observations showed that it was bonding and not very reactive. At least all this warm weather has been good for something.

I'd stay off of anything steep and windloaded today since these newly formed pillows would be and the Lionhead area around West Yellowstone, the avalanche danger on slopes steeper than 35 degrees is **CONSIDERABLE** if it's windloaded and **MODERATE** if it's not. On all lower angled slopes the avalanche danger would be **LOW**. Be aware that the avalanche danger will

rise if it continues to snow today. During, and immediately after a storm is when you can most likely trigger a slide.

The mountains around Cooke City and the Washburn Range

Cooke City, acting like a big catcher's mitt, got over a foot of snow in about 12 hours. Additionally, they've been getting strong enough winds to easily form wind slabs. These slabs could be quite thick, and if there were visibility I'd expect to see natural avalanches on these windloaded slopes. The snowpack here has a buried weak layer of facets sitting about 3 feet under the surface. The warm weather certainly helped strengthen them; however, quickly adding over an inch of water could bring it back to life. Like the rest of our area, I'd be careful about the steadily rising avalanche danger if it continues to snow.

For today, for the mountains around Cooke City and the Washburn Range, the avalanche danger is **HIGH** on all windloaded slopes, **CONSIDERABLE** on non-windloaded slopes steeper than 35 degrees and **MODERATE** elsewhere.

For a description of the Avalanche Danger Scale click on: www.avalanche.org/usdanger.htm

Ron will issue the next advisory tomorrow morning at 7:30 am. If you get out into the backcountry let us know what you're seeing. You can leave a message at 587-6984 or send an email to gnfac@avalanche.org.

SNOWMOBILE BROCHURE

Rescue Safety

IF YOU ARE A RESCUER:

■ Watch the victim! Establish the last seen area.

AVALANCHE DANGER SCALE

LOW	• Natural avalanches VERY UNLIKELY. • Human triggered avalanches UNLIKELY. • Travel is GENERALLY SAFE. • NORMAL CAUTION is advised.
MODERATE	• Natural avalanches UNLIKELY. • Human triggered avalanches POSSIBLE. • Use CAUTION in steeper terrain on certain aspects.
CONSIDERABLE	• Natural avalanches POSSIBLE. • Human triggered avalanches PROBABLE. • Be INCREASINGLY CAUTIOUS in steeper terrain.
HIGH	• Natural/human triggered avalanches LIKELY. • Travel in avalanche terrain NOT RECOMMENDED.
EXTREME	• Natural/human triggered avalanches CERTAIN. • Travel in avalanche terrain should be AVOIDED and confined to low angle terrain well away from avalanche path run-outs.

Cornice Safety

CORNICE BREAKS AND CATCHING BIG AIR:

RECOMMENDED READING:

U.S. Avalanche Centers

ALASKA
- Chugach National Forest Avalanche Center
  www.fs.fed.us/r10/chugach/glacier/know.htm

CALIFORNIA
- Mount Shasta Avalanche Center
  www.shastaavalanche.org
- Central Sierra Avalanche Center
  www.r5.pswfs.gov/tahoe/avalanche.html

COLORADO
- Colorado Avalanche Information Center
  www.geosurvey.state.co.us/avalanche

MONTANA
- Gallatin National Forest Avalanche Center
  www.mtavalanche.com
- West Central Montana Avalanche Center
  www.fs.fed.us/r1/lolo/avalanche/advisory.htm
- Glacier Country Avalanche Center
  www.glacieravalanche.org

IDAHO
- Sawtooth National Forest Avalanche Center
  www.avalanche.org/~svavctr
- Payette National Forest Avalanche Center
  www.fs.fed.us/r4/payette/main.html
- Idaho Panhandle Avalanche Center
  www.fs.fed.us/ipnf/visit/conditions/index.html

NEW HAMPSHIRE
- Mount Washington Avalanche Center
  www.tuckerman.org

UTAH
- Utah Avalanche Center-SLC
  www.avalanche.org/~uac
- Bear River Avalanche Information Center
  www.avalanche.org/~uac/BRAIC
- Manti-La Sal Avalanche Center
  www.avalanche.org/~lsafc

WASHINGTON & OREGON
- Northwest Weather and Avalanche Center
  www.nwac.us

WYOMING
- Bridger-Teton National Forest Avalanche Center
  www.jhavalanche.org

Highmarkin' Safety

If you learn nothing else, remember that if you like to ride onto steep slopes, do so ONE AT A TIME with the rest of your group watching from a safe spot. DO NOT PARK AT THE BOTTOM of a steep slope and DO NOT GO HELP SOMEONE WHO HAS THEIR SLED STUCK. These travel procedures alone would cut the number of fatalities in half.

Anything steeper than 25° can avalanche, but prime time slopes are 30°–45°, the same slopes most of us like to play on. You don't have to be on a steep slope to make it avalanche, you just have to be connected to it.

■ ALLOW ONLY ONE RIDER AT A TIME ON THE SLOPE. IF A PERSON GETS STUCK, DO NOT SEND A SECOND SLEDDER TO HELP!!!

■ EVERYONE SHOULD BE WATCHING THE CLIMBER FROM A SAFE SPOT.

■ ALWAYS PARK WELL AWAY FROM THE BOTTOM OF STEEP SLOPES.

Travel Smart

TRAVEL SMART:

AVALANCHE RESCUE: The best defense is not to get caught. You don't have time to go for help. YOU ARE THE HELP!

TOOLS FOR AVALANCHE RESCUE:
Brain, beacon, probe, and shovel.

IF CAUGHT IN AN AVALANCHE:

EMAILS AND SUPPORT LETTERS

Doug,
Thanks for orchestrating the production and distribution of Doug and Jill's flier to the lower 48! Looks great and we are very happy to have a few thousand. Good job getting it out so fast! We need it now - snowmobile fatality south of Tahoe recently and we have 17+ feet and climbing! Still doing daily advisories...
Great job Doug - Thanks!
Eric White
Mt. Shasta Avalanche Center
ewhite@fs.fed.us

FROM THE BOTTOM OF MY FLATLANDERS HEART-THANKS SO MUCH FOR ANOTHER SEASON! BY READING YOUR REPORT EVERY DAY IT BECOMES SECOND NATURE TO BE AWARE OF THE CONDITIONS. WE WERE FORTUNATE ENOUGH TO MAKE SEVERAL TRIPS TO THE ISLAND PARK AREA THIS WINTER. BY LEARNING WHAT TO WATCH FOR WE HAD A PERFECT RECORD WITH NOT EVEN A CLOSE CALL.THANKS AGAIN AND WE'LL BE LOOKING FORWARD TO ANOTHER SEASON.
MARK LINDY

hanks for your great work, again, this winter
saved my ass many times, no doubt,
We posted your reports in the Co-op's seating area almost daily
and helped many keep informed.
Remember to ask us, the Community Food Co-op,
for a donation of refreshments next fall
for any fund raising events.
Dana Huschle
CFO, Community Food Co-op
406 587 4039

Thank YOU for helping keep us alive this winter! We'll see you next winter!

I ride and slide in the Crazy Mountains about 4 days per week. I want to thank you guys for all the excellent reporting this year and am looking forward to the reports continuing next season. I am leaving today to ride and slide the Crazies for maybe the last time this season. I'll miss the winter.
Dan
canbar@mcn.net

Thanks again guys for the season of updates! Even though I'm a Midwesterner, I find it very informative and interesting. We usually try to get out to the mountain areas once or twice a winter. We wrapped up our club snowmobile season this weekend as well with our end of the year banquet/meeting. Temps were in the 80's here on Saturday! Made for a nice day to pull all our markers and signs for our snowmobile trail!
I need a little advice if you're willing to give. We've been discussing the purchase of beacons, probes, and shovels for our club. The thought is that we'd purchase 6 sets and have available for a donation/rental for members to

use when they were making trips out to the mountains. We'd continue to add to the equipment, update, etc with the monies taken in from usage. There seems to be some hesitancy from some of the club members. I think its a great idea because I'd use the equipment whenever I made a trip. We also have an opportunity to buy the equipment at cost due to the offer from a local supplier! What would be you're best advice on the situation?
Again, thanks for the work you guys do to make snowmobilers, skiers, etc aware and safe!
Ray Oines
Brookings, SD

I'd like to thank you guys for another informative season , I've learned alot from your avalanche reports over the last two seasons and the information you give out has made me a safer more alert sledder.
Again, Thanks and have a great summer.
Jay Grimsrud
Fairview,Mt.

Just want to thank all of you for your time and effort.
Sincerely, Mark Johnston
Ron - Thanks for all your work this season. I have certainly appreciated it here in Minneapolis.
Michael Helffrich

Guys -
Thanks again Ron, Scott, and Doug for the fine job of reporting snow conditions over the course of the year. I look forward to reading it every morning!
Now let's hope for some more gnarly, big spring storms and cold temps (not a popular wish here around DNRC, except maybe the hydrologists) and a slow, and incremental run-off - then lots of rains this spring!!
Jess Aber,
Governor's Drought Committee and DNR WRD.

Your doing a great job and providing a valuable service. Thank you for your thorough and extensive education and advisories. I learned a lot just by reading all the forecasts each day and then getting out on the snow to observe what you have talked about. There can be no question that it has and will save more lives.

My first ever trip was to cooke city. I was in cooke city last year on tour of big sky,both sides of the road in Yellowstone, and a 4 day stop in island park on Jefferson and across the road.Yes cooke city is responsible for my now addiction.I run a white lighting with a 1080 psi and now a 400 lb. f7 white lighting waiting for the turbo. Both of course equipped with shovel,probe,mounted gps,and I also wear a fanny pack with first aid,batteries, snacks,tools, fire starter,boy scout stuff,for Murphy's law from my skiing days.I know in my extreme ski days your suppose to wear you shovel and probe. Have fun
Bryan.
p.s. I drive a big red Sterling tractor with a 32' body and checkers. Honk if we go buy, next stop revelstoke.

Hi All,
I just wanted to thank you and particularly Scott for coming up to Buck Creek with the GVSA last Saturday. I have been wearing a beacon for a few years and felt fairly comfortable that I'd be able to find someone with it. Scott showed me how wrong I was. I was amazed that once I got into the general area I had no idea what to do. Scott showed us how to do the grid search and find the fade points to zero in on where to probe. My partner and I went to the second beacon that was buried and I was able to find it much faster. I've learned that I still need more practice. I was horrified to find out how little I knew about finding someone.
I wanted to let you know how much we learned and appreciated you coming along!
Sincerely,
Mary Schonsberg

Doug,
Wnted to thank you again for the excellent presentation you put on for the Snowest forum group in Island Park last month. Excellent show with great slides. I also read your research and the presentation you gave last year in Okanogan/Penticton...nice piece of research and writing. Appreciate very much that you guys are trying to tailor programs to the special needs of sledders, and for not taking a condescending attitude. I believe that your approach will eventual reach the majority of sledders...thus saving countless lives.
I think you are on the right track with stressing to sledders the importance of NOT going up to rescue a stuck buddy. The recent incident on Mt Abundance, regrettable, reinforced that. I am stressing that whenever topics of avalanches, sleds, backcountry comes up in discussions at work or at play.
Thanks once again for all the hard work you and the rest of the Bozeman crew do.
Tony Sabol
Big Sky X

You do such a wonderful job describing the conditions! unfortunately my friends ride in the towagatee pass area and I only come your way maybe once a year since I'm from north eastern Minnesota and actually grew up at our island in Canada I love extreme snowmobiling.[it is a 20 mile ride to the road which is 70 miles from town] Were going back for the hill climb now and I fell so uninformed of the snow conditions their report is terrible.I read yours for education and can not express how well written it is, I fell like I know the snow when I'm done. I truly appreciate your groups work, being a flatlander but also a top ussa ski racer in the past I am truly concerned how midwest riders dont respect the mountain and the reality of an avalanche.keep up the good work!!
Bryan Fisher

Nice forecast today, Doug, I always enjoy reading yours. Not that Ron's and Scott's are bad, it's just nice to see somebody use semicolons properly! Not to mention that the phrase "diurnal fluctuations" has a nice ring to it. If you don't mind, I'm going to use it in my daily conversations:
"Would you like cream in your coffee?"
"No thanks, it gives me diurnal fluctuations."
Mike

Just a quick msg from over here wher the pacific storms are pounding and I wish it would convert to snow there (Oh here is Portland area) I, along with a large contingency of friends make regular trips to the West Yellowstone area to enjoy the scenery and snowmobile. We travel at least twice a year so you page is great information for us. I receive it and then forward it to others. Our first trip is planned for January 4 through 13. We are hoping for a good fall between now and then. Any information you can provide would be greatly appreciated. I like the way you deliver the information; it is like we are talking one on one. Keep up the great work
Jim Gamble

YELLOWSTONE CLUB

Gallatin National Forest Avalanche Center
Doug Chabot, Director
PO Box 130
Bozeman, MT. 59771

Dear Doug,

I would like to congratulate you and your crew on a job well done this year. Now that the winter season is winding down I would like to thank you, Ron, and Scott for your first rate job of weather and avalanche forecasting. With this years early drought conditions and then the heavy snow of February and March it was extremely valuable to read, on your web page, your advisories and weather forecasts. Of course, the early morning discussions on days of heavy snow and wind were helpful in developing a safe and efficient control plan for the day.

Also, a belated thank you to you for conducting a day long avalanche course during our preseason Snow Safety Refresher. Feedback from the Ski Patrol and Guides indicated that the classroom time, as well as the field session, was a great way to prepare for the season.

Sincerely,

Tom Leonard
Snow Safety Director

ph 888/700-7748 fax 406/995-3864
One Yellowstone Club Trail / Post Office Box 161097 / Big Sky, MT 59716

ANDERSON SCHOOL DISTRICT NO. 41
10040 Cottonwood Road
Bozeman, Montana 59718

April 15, 2003

Douglas Chabot, Director
Gallatin National Forest Avalanche Center
P.O. Box 130
Bozeman, MT 59771

Dear Mr. Chabot:

I am writing in thanks of the recent avalanche seminar you presented to some of our seventh and eighth grade students. Feedback from our students was highly positive and most even wanted you to return the next week! Your Power Point slideshow and discussion aligned well with previous materials our class had studied about avalanches and the outdoors. Additionally, the content was age-appropriate and was an excellent introduction to backcountry precautions for a collection of students most surely to venture into the backcountry in the coming years.

Anderson School would love to invite you to give another presentation to our students next school year. I have had younger students browse the GNFAC web page and they would love to see your presentation. Please consider returning to our school when scheduling community events next winter. Our future backcountry skiers, boarders, and climbers will appreciate it.

Thanks again from Anderson's staff and students.

Sincerely,

Steven Heise
Extended Studies Coordinator

Monforton School
6001 Monforton School Road • Bozeman, MT 59718
(406) 586-1557 • FAX – 587-5049

June 12, 2002

Karl,

Recently you met with some of my students from Monforton School. I would like to take the opportunity to personally thank you for finding time to share your expertise with my students. Your example helped each of them gain additional knowledge in the area they were studying and also provided an excellent role model of professionalism.

Again, thanks for your help.

John Graves

J Graves

8th Grade Instructor
Monforton School

Sarah

Austin

Jessie Yang

Jessie Saunders

3/26/03

DEAR MR. CHABOT,

THANKS SO MUCH FOR COMING IN TODAY TO TEACH US ABOUT AVALANCHES!

Bill

Steven Ellis

Steven

Carter Marrane

&

7/8th GRADE ANDERSON STUDENTS

Lewis and Clark Search and Rescue Association

A Non-Profit Volunteer Organization
"SO OTHERS MAY LIVE"

January 17, 2003

Ron Johnson
Gallatin National Forest Avalanche Advisory Center
Federal Building
10 E Babcock
Bozeman, MT 59715

Dear Ron:

The Board, the Training Committee and unit members of the Lewis & Clark Search & Rescue Association extend a sincere thanks to you. Your assistance in the training organized by Ray Paige for avalanche awareness is appreciated.

As you know, training of this sort just cannot be provided without the help of others like you. It had been over three years since we last did anything on avalanche so the timing was right. It was great for the new members and always good as a refresher for the rest of us. Avalanche is not something we deal with much but when it happens we sure need to know what to do. We liked the training because it really focused not only on prevention and awareness but also on rescue aspects. Of course, this is good because it means our members are better able to do their work.

I heard lots of comments about the quality of your presentation, your presentation style, your materials, and on and on. Just wanted you know that folks thought you were an excellent presenter who knows his subject matter well. A high compliment from this group.

I'm always appreciative, as a taxpayer and consumer of services, to see organizations supporting each other. This is just good business for all of us.

P.O. Box 473, Helena, Montana 59624 (406) 442-7880

So, thanks for lending our members a hand. (And making many of us jealous over what you have to do for work. We always think, well, maybe in our next career. The Tetons are my favorite place...tough duty.)

Sincerely yours,

Janice

Janice Frisch
Board Member

BIG SKY
INSTITUTE
For Science & Natural History

January 30, 2003

Mr. Chris Lundy
Gallatin National Forest Avalanche Center
P.O. Box 130
Bozeman, MT 59771

Dear Chris:

I wanted to personally thank you the time you generously gave to the Big Sky Institute program "*Avalanches: What You Need to Know.*" last weekend. I am particularly grateful because I know of the many demands on your time, especially during this busy avalanche and patrol season.

As you know, the course was well-attended and I have heard from a number of participants that they felt your presentation was as enjoyable as it was informative. BSI prides itself on linking researchers and scientists working in the Yellowstone area with educators and the public, disseminating scientific knowledge with the hope that we can, one and all, be good stewards of the world's national treasures, as well as become more aware of the environment in which we all live and play.

As educators, we both understand the tremendous value of connecting with an audience and imparting knowledge to make for better understanding of the complex issues facing the world today, including avalanche awareness. Based on comments I have heard from the workshop participants, I would say that you achieved this through your presentation.

Once again Chris, thank you for the time and energy you provided to BSI's winter Science Adventures in Geology and Ecology (SAGE) community education program.

Sincerely,

Lisa J. Graumlich
Executive Director

MONTANA State University

Big Sky Institute · Montana State University · PO Box 173490 · Bozeman, Montana 59717
☎ (406) 994-2374 (406) 994-5122 bsi@montana.edu bsi.montana.edu

MONTANA

Pronghorn, often mistakenly referred to as antelope, is the fastest animal in the Western Hemisphere. Making 20 foot bounds, it has been clocked as high as70 mph for short periods. With an average speed of 45 mph, it can easily maintain 30 mph for as much as 15 miles.

Photo: Steven A. Page

2-14-03

2003

Penks to Prairie

OF ORIGINAL WEST

Thank you for a wonderful, informative presentation on an avalanche. I have been sharing your info and hope it saves some lives. Thank you for not saying - Don't go but just "Don't go today

Robin - x-country skier

Penks to Prairie Dist. LLC

Gallatin Forest Avalanche Center

Ron Johnson

Bozeman MT

Do not write below this line.

2USMT-168

Designed & Printed in the U.S.A.

"Gilbert, Steve"
<sgilbert@state.mt.us
>

To: "gnfac@avalanche.org" <gnfac@avalanche.org>
cc:
Subject: YNP backcountry trip

03/07/2003 11:58 AM

Hi Fellas,

Just back last night from 6 days in YNP backcountry. My pal and I skied from South Entrance, up Snake River to Heart Lake, did a loop down Basin Creek to Snake River, then down the river and back to South Entrance. Big snowfall the evening and night of the 5th moved by very high winds. Vertical cornices already existing along windward slopes (this was a new one for me...I think the cornices are due to burned areas and lots of outcrops on windward slopes) were being added to, and south and west facing aspects that had some melt-crust from sunny days was already sloughing yesterday...just the 6-8 inches that fell that night. I expect those areas and wind-loaded slopes to be really scary over the next few days. We weren't there to challenge the slopes and didn't, but still saw lots of evidence of large streamside cornces having slid in the not-so-distant past...and more forming. Ridgetop winds were scary and existing cornices were being added to quickly.

We skied down about 4 miles of Snake River...ice formed (I think) during the -40 to -50 below spate of weather there a week or ten days ago...and the snow on the ice (10 inches to 2 feet) was mostly unconsolidated wind deposited stuff...very fine and floury...and harder than hell to push through. It was interesting because on the edge of the river or in the trees where snow had set up, the skiing was very easy.

My partner and I always count on your wonderful reports...and marvel that the reports out of Jackson Hole area, Sun Valley, etc., aren't up to your standards. With a little extrapolation of data from the Gallatin, Madison, Cooke City and West Yellowstone areas, we feel like we have a pretty good handle on YNP snow conditions. This year was no exception (I've been doing backcountry trips in YNP for over 30 years) to the norm. There are places where wind-loaded snow on a crust about 3 feet deep slid, places where it slid all the way to the ground on that first layer of hoar...and lots of areas where it seemed like sugar snow from top to bottom.

Thanks for your good work. It always makes me feel like I'm a step ahead in understanding what I might come across because I read your reports daily.

Steve Gilbert
Non-motorized Trails Specialist
Montana Fish, Wildlife and Parks

United States Department of Agriculture | Forest Service | Lewis and Clark National Forest, Belt Creek Ranger District | 4234 Hwy 89, Neihart, MT 59465, 406 236-5511, FAX 406 236-5507

File Code: 1600/2360
Date: April 22, 2003

Gallatin National Forest
Avalanche Center
PO Box 130
Bozeman, MT 59771

Dear Doug Chabot, Ron Johnson, and others:

On behalf of the Lewis and Clark National Forest, I would like to Thank You and your fellow employee's for their contribution to avalanche safety here on the forest, especially Ron Johnson.

We had great response from the local clubs and Forest Service employees. Many who could not make it to last years presentations plan on coming to next years.
Some plan on attending again for refreshing their memories and working with the transceiving systems.

We plan on scheduling another one or two sessions for next year. Here in the Little Belt Mountains, winter recreation has grown considerably in the last five years. The snowmobilers are taking their sleds in places we have not seen sleds before, and many of the places have avalanche potential areas. Our involvement in winter recreation has let us work with the clubs closely and one of their requests is more information on safety, including avalanches and winter survival. Our goal is to continue to use the Gallatin Avalanche Center for help in informing the public, and help someone in saving a life. It would really feel good for someone come back and say if it wasn't for the course on avalanche safety you put on, I would not be here today. Many others and I support the Avalanche Centers.

Thanks again, and we hope to contrive to work with you in the future!

Sincerely,

CHARLENE BUCHA GENTRY
Acting District Ranger

cc: John C Metrione, Bob Gliko

SMS
FALCONS
Bozeman Public Schools

Sacajawea Middle School
3525 South 3rd Avenue
Bozeman, MT 59715
Phone: (406)522-6400
FAX: (406)522-6474

Diana McDonough, Principal
Diane Cashell, Assistant Principal

April 25, 2003

Dear Avalanche Dudes,

The seventh graders at Sacajawea Middle School enjoyed your avalanche presentation and slideshow (as usual!) Every year the presentation gets better. I think that the middle school years are the perfect time to increase avalanche awareness in our students. As I told Doug this Fall, I would like to see our eighth graders be a part of the education program too. An outdoor element for upper middle schoolers would be a great addition to the education component of the Avalanche Center. A short class similar to the community education you do including digging snow pits, studying weak layers, and evaluating terrain.

Again, thanks for making it easy for the teachers with your reminder calls in the Fall. Your organization and emphasis on education is truly extraordinary. As a outdoor enthusiast and teacher, I appreciate all you do here in Bozeman!

Sincerely,

Jennifer Royall

United States Department of the Interior

NATIONAL PARK SERVICE
PO Box 168
Yellowstone National Park
Wyoming 82190

IN REPLY REFER TO:

A3415(YELL)

MAR 0 4 2003

Thank you Ron & Jeff!
Becky

Ms. Becky Heath
Supervisor, Gallatin National Forest
P.O. Box 130
Bozeman, Montana 59771

Dear Ms. Heath:

We would like to express our gratitude for providing two of your staff, avalanche forecasters Ron Johnson and his assistant, Jeff Deems, to teach a full-day session during our avalanche/SAR training recently held at Yellowstone National Park.

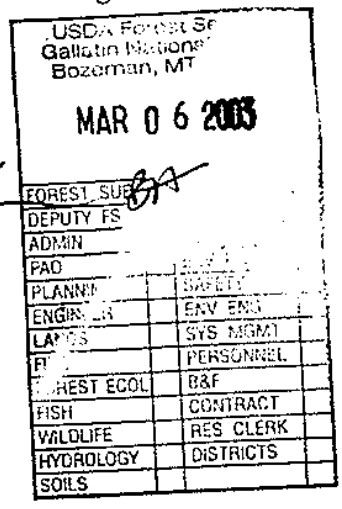
Ron and Jeff conducted a classroom session early in the day on February 12, then a field session later the same day in the hills surrounding Cooke City. They consistently provide top level, expert instruction on snow pack analysis and stability evaluation. We appreciate that Ron has been able to attend our yearly training and provide quality instruction. All participants offered positive comments regarding his presentation, the information provided, and his open and friendly style.

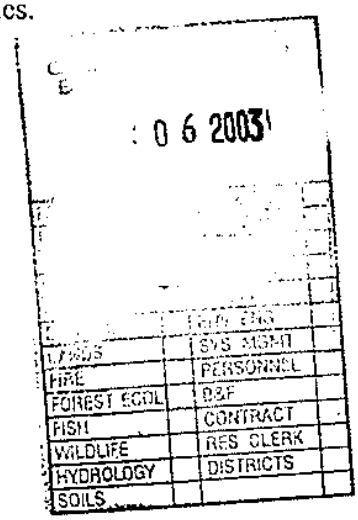
We sincerely hope that the close working relationship we have with the Gallatin National Forest Avalanche Center will continue for years to come.

The Lamar and Northeast Rangers and I would like to again thank you for providing this very valuable assistance. Yellowstone would likely be a more dangerous place without this team effort to provide training and assist with rescues.

Sincerely,

for Suzanne Lewis
Superintendent





Black Diamond

Black Diamond Equipment, Ltd
2084 East 3900 South
Salt Lake City, UT 84124
Phone: 801.278.5552
Fax: 801.278.5544

Black Diamond Equipment, AG
Christoph Merian Ring 7
4153 Reinach (BL), Switzerland
Phone: +41/61 71 31 61 0
Fax: +41/61 71 31 61 1

www.BlackDiamondEquipment.com

August 26, 2002

Mr. Dale Bosworth, Chief
USDA Forest Service
Sidney R Yates Federal Building
201 14th Street at Independence Ave SW
Washington DC 20250

Dear Chief Bosworth,

The attached letter is signed by the CEO's and Senior Managers of America's $5 billion/year outdoor Industry and is written in support of the Forest Service's Avalanche Forecast Centers.

The signatories include: Patagonia, Eagle Creek Travel Gear, Outdoor Retailer (industry tradeshow producers), Cascade Designs (large holding company), Rivers and Mountains, Watermark Sports, Asolo Boots, Mountain Hardware and of course Black Diamond Equipment. In addition, I have received phone calls of support from Nike/ACG, Marmot, Gregory, Osprey, Vortex and several other companies.

I think you will agree with me when I say, "it is gratifying to see such a strong show of support" from the leading companies of America's outdoor Industry in support of a Forest Service Program. Please read the attached signed letter to understand why that support is there.

I am also sending copies of this and the attached letter to those elected representatives who have residing in their states at least one of the Forest Service Avalanche Forecast Centers.

Sincerely Yours
BLACK DIAMOND EQUIPMENT LTD

Peter Metcalf
CEO/President

Cc: (with attachments)
Bruce Greenstein, Chairman, The American Avalanche Advisory Fund

Frank Hugelmeyer, Executive Director of the Outdoor Industry Association

Dale Bosworth, Chief
USDA Forest Service
Sidney R. Yates Federal Building
201 14th Street at Independence Avenue SW
Washington, DC 20250

Dear Chief Bosworth:

We want to congratulate and thank the Forest Service for the great job your backcountry avalanche centers do.

We recently saw statistics that showed that avalanches kill more people on National Forests than any other natural event and that nearly all avalanche fatalities occur on National Forests. The fatalities span the spectrum from snowmobile riders and backcountry skiers to hunters and snowshoe hikers. It is obvious to us that without the avalanche centers there would be many more avalanche fatalities on National Forests.

But saving lives is not all the avalanche centers do. Avalanche centers also provide a positive way for the public to participate in a Forest Service program. The public heartily endorses the avalanche centers and they have shown their support by establishing friends' organizations that provide significant funding for local avalanche centers. This sort of enthusiastic support seems refreshing in an age when many government programs are openly questioned and criticized.

Outdoor-industry retailers and manufacturers in turn support local friends' organizations by providing them staff services, products, and funding. The industry has also worked closely with the Forest Service National Avalanche Center to increase public avalanche awareness. Some of the projects we have worked jointly on include an avalanche awareness video for snowmobile riders, an avalanche awareness video for backcountry skiers and snowboarders, and avalanche danger scale hang tags.

We feel that public safety is a shared responsibility. We look forward to working even more closely in the future with both the Forest Service's local avalanche centers and with the National Avalanche Center. The overall Forest Service avalanche program provides a very popular and valuable service to the public. We thank you for providing this service and we urge you to continue your support.

Sincerely,
The Leading Companies Of America's Outdoor Industry,

Black Diamond Equipment Ltd.
CEO/President

United States Department of Agriculture | Forest Service | Washington Office | 14th & Independence SW
P.O. Box 96090
Washington, DC 20090-6090

File Code: 2300-1/2700-1
Date:

Peter Metcalf
CEO/President
Black Diamond Equipment, LTD
2084 East 3900 South
Salt Lake City, UT 84124

Dear Peter:

Chief Bosworth asked that I respond to your August 26, 2002 letter regarding support for avalanche centers.

I would like to thank you and the other signatories to your letter for the ongoing support for the avalanche program. As stated in your letter avalanches are an ongoing danger to the users of the backcountry. Exposure to such danger will only increase as more people visit the backcountry, driven by their desire to experience the beauty of the backcountry and the use of improved technology.

To counter act such exposure, it will take a combined effort by all interested parties to create and implement education programs and provide for forecasting centers. It can not be accomplished by the federal government alone, nor should it be strictly the responsibility of the Forest Service. Such programs benefit many.

In this era of limited federal budgets, I want to once again thank you for your support and welcome your efforts to continue that support, whether it be through volunteer services, product development, or direct financial support.

Sincerely,

DAVID G. HOLLAND
Director, Recreation, Heritage, and Wilderness Resources

cc: Doug Abromeit

Thursday, April 10, 2003

To Whom It May Concern,

Every fall our seventh graders at Chief Joseph Middle School start to think about "hitting the slopes." Seventh graders are at an age when they are becoming ready to venture out on their own while skiing, snowboarding, or riding snowmobiles during the winter months.

The Avalanche Center is a great resource we have been tapping into for the last several years. Each fall avalanche experts present information to our students promoting safety while participating in winter sports. Through a combination of scientific facts, handouts, models, and video examples the students are taught information that is thrilling, interesting, and could end up saving their lives.

We have a total of about 170 seventh graders. The Avalanche Center is instrumental in exposing each of them to facts that are important to every individual living and playing in Montana in the wintertime.

This is a great partnership and we hope to continue sharing this knowledge with our students every year.

Sincerely,
Ann Cannata

NEWSPAPER AND MAGAZINE ARTICLES

BOZEMAN DAILY CHRONICLE

A4

TUESDAY, JANUARY 7, 2003

OUR OPINION

Let's let last year's record stand for all time

Montana set a record last year that we don't want to best again this year: Eight people died in avalanches last winter, the most ever in a single season, and all of them were snowmobilers.

This winter's slow start may have lulled some into a false sense of security, but in fact the scant early-season snow created conditions that could lead to more danger.

At least two snowmobilers got a rude awakening to that danger when they were buried in separate avalanches in the Cooke City area during the last week of December. In an encouraging turn of events, the parties with whom the victims were sledding were equipped with avalanche transceivers and other safety equipment and both were rescued. A few short years ago, transceivers, probes and shovels were rare among snowmobiling groups.

The rapid proliferation of backcountry winter recreation has spawned the creation of avalanche tracking services.

Though there was no official record made, a Forest Service winter sports coordinator said he heard of two other people who were buried but rescued during the same week. Snow experts said the the thin snow cover created a particularly weak layer of snow that led to the dangerous conditions when more snow settled on top.

Though fatalities have so far been avoided, a few cautions bear repeating.

The rapid proliferation of backcountry winter recreation has spawned the creation of avalanche tracking services. Locally, the Gallatin National Forest Avalanche Center provides a wealth of information on current avalanche conditions. Wise backcountry recreators — both motorized and non- — will make use of this service.

The center's daily advisory is posted on its Web site at http://www.mtavalanche.com/. It can also be heard by calling 587-6981.

In addition to the advisories, the center provides a wealth of avalanche education and training programs for a nominal cost. That training (details are posted on the Web site) provides the knowledge needed for the proper use of avalanche rescue equipment that should be part of every winter backcountry excursion. This includes avalanche probes, shovels and transceivers, which are electronic beacons that can allow the quick location of a buried avalanche victim.

All accidents are preventable, but recreational tragedies are particularly preventable. If you're heading into the backcountry, learn about the dangers, how to avoid them and how to deal with accidents when they happen. This knowledge can ensure that you live to return and recreate another day.

AVALANCHE PRIMER

Ensuring your safety in the early season snowpack requires an understanding of avalanche danger

Doug Chabot is the director of the Gallatin Valley Avalanche Center (GNFAC). He can be reached at 587-6984 or at dchabot@fs.fed.us.

The first issue of Carve is a sign of the changing seasons. The warmth and long days of summer are gone as we begin preparations for another Montana winter. I was forced to scrape the frost off my windshield with a credit card the other day, and as my fingers numbed it reminded me, among other things, to find the ice-scraper and to start preparing for cold, snowy weather. Headlines are claiming an El Nino winter; warm and dry, and devoid of fun. Well I'm not buying it. The beauty of the fall is that it allows us to hope and dream about the deep powder that we'll all be choking on soon. And I see no reason to destroy that vision, no matter what the papers say.

As soon as the first snowflakes hit the ground skiers head to the mountains, no matter how thin the snow cover, marking the unofficial kick-off to winter. All of us at the Avalanche Center are preparing for this, excited with the possibility of an early and prolific season. Some of the hurdles we face in preparation for the coming months involve everything from the mundane logistics of trying to find our gear, repairing our broken equipment that we put away in haste last spring, and most importantly, jarring our brain into thinking about snow and avalanches.

Chris Kerr

Skiers and snowboarders need to prepare themselves for the dangers they may encounter in their backcountry travels.

My first outing of the year always ends up being a big shakedown trip as I fumble my way into the hills. In past years I've forgotten my pit hook, shovel, skins, even my poles as I rushed out the door forgetting the ski patrol mantra of "skis, boots, poles, hat, gloves, goggles". Not this year though. I'm getting ready, and so should you.

Find your beacon, and treat it to a set of fresh batteries. Taking your AAs out of your walkman and putting them in your transceiver doesn't cut it. Spend a few bucks to guarantee it's going to work. And while you're at it, practice using the thing. Hide your partners beacon in the sofa or out in the yard and search for it. This'll start to brush away the cobwebs and resharpen your skills. Next, find your shovel and probe poles. Is your shovel cracking? Get a new one. Do your probes slide together easily, or do you have to force the sleeves to mate? I treat the sleeve connectors with a touch of graphite lubricant at the start of the year to make them fit like new. The same goes for your ski poles if they're the type that double as probes. I also put together a little stuff sack with some emergency essentials: a small repair kit, some hand warmers, a mini-light and matches. A kit like this will cut down on your suffering when things go wrong. And things definitely can go wrong.

Sure, you'll need to check your skis, bindings and belts on your snowmobile too. But most important is getting your mind in shape for the complicated decisions you'll need to make in the backcountry. Is it safe to ski or highmark this slope? Where's the best route? What if someone gets caught in a slide? Just like studying for a test, I recommend doing some homework in preparation for the final exam you're going to find out there. It's a simple pass/fail quiz. But the consequences of failing can be grave.

So what should you do? I recommend reading a few good avalanche books and watching a video or two as the first step. For those wanting extra credit, take one of the avalanche classes we offer each year. For readings I recommend either Staying Alive in Avalanche Terrain by Bruce Tremper, or Snow Sense by Fredston and Fesler. And for the videos Winning the Avalanche Game or Beating the Odds are good primers. These books and videos can be found at the local outdoor stores or online at www.csac.org/store. While these books and videos are great refresher tools, they're no substitute for formal education.

If you love playing outside in the snow you should treat yourself to an avalanche class. There's a Basic Avalanche Awareness class offered through the Outdoor Rec. department at MSU on the evenings of December 4th and 5th with an all day field session on the 7th. You can call ASMSU at 994-3621 for further information. A similar course, but tailored specifically for snowmobilers, will be offered December 5th and 6th at Team Bozeman with a field session on the 8th. You can register for this by calling 587-4671. A full listing of our classes are on our web site www.mtavalanche.com. While you're there, you may want to signup for our free email advisory service. Once we start putting out the daily advisories we'll email you the bulletin in time to read it with your morning coffee, or as always, you can call our hotline at 587-6981. ◆

CARVE OCT 2002

WINTER'S FOUNDATION

Testing the snow's stability is key to having a safe and glorious day in the backcountry

Doug Chabot can be reached at 587-6981 or at dchabot@bridgerbowl.com

When I read the paper every morning I see ads for the newest skis, most powerful sleds and warm, stylish clothes. Retailers are announcing that winter is coming and I'm ready. Actually, I'm more than ready. I feel like a frenzied racehorse ready to explode down the track, and the starting gun is the season's first snowfall. I know I'm not alone in my excitement to get into the mountains, but experience tells me we need to curb our enthusiasm a bit. We need to be smart about our initial forays because as the first folks hit the slopes we always get reports of human-triggered avalanches. A common quote we hear is "I didn't know there was enough snow to avalanche." Remember, if there is enough snow for you to be sliding on, then there's enough snow to avalanche.

Doug Chabot

A skier performs a stability test in the Bacon Rind area.

It can still be brown in the valleys, but as long as the mountains have traces of white, skiers and snowboarders will search for the deepest snow, usually found near ridgetops and gullies from wind deposition. Wind is incredibly effective at moving snow and can greatly improve your skiing by covering rocks and other obstacles. But that's not all it does.

At the beginning of the season wind blown snow adds weight to an already thin, and sometimes weak snowpack which can raise the slopes instability. While good skiing is usually found in these deeper and isolated pockets of snow, this is also where people trigger avalanches. In years past similar conditions contributed to the avalanche fatalities of a skier and two hunters in our area and countless near misses.

When we think of snow we usually visualize fragile, star-like crystals. However, snow is very dynamic and these snowflakes change rapidly once they're on the ground. With a thin snowpack and cold air temperatures, common conditions in the autumn, the snowpack can significantly weaken by the formation of depth hoar crystals. These large grained, faceted crystals are created by large temperature differences between the warm ground and cold snow surface. Once formed, this weak layer at the ground, like a poor foundation on a house, won't support much weight. Like adding the last straw to a camels back, sometimes all it takes is a skier, snowmobiler or load of new snow to tip this delicate balance and cause an avalanche.

Our ability to grasp snow stability boils down to understanding the relationship between various layers of snow. A little investigation can go a long way toward reducing your exposure to avalanches. Questions to ask are, "Is there a weak layer between two stronger ones?" and "Are the layers bonding together?" The only way to answer these questions is to get outside, dig around and perform a few stability tests before careening down the slope. It's relatively easy to search for depth hoar in a thin snowpack by poking your pole or hand in the snow to see if faceted, sugary, loose snow is at the ground. Depth hoar by itself poses no danger, but if it's underlying a larger slab of snow you may want to choose a different route. Nature's warning signs of unstable snow include recent avalanche activity, "whumphing" or collapsing of the snowpack, and cracks shooting out from your skis. Whenever I see these classic signs of instability I stay clear of avalanche terrain no matter how good I think the skiing will be.

Avalanche Center Photo

A little investigation can help you avoid avalanche dangers in the backcountry.

Let's face it, understanding snow stability can be time consuming and confusing. There's no way around it, but there is some help. Our mission at the Gallatin National Forest Avalanche Center is to help you make good, safe decisions in the backcountry by providing daily avalanche advisories. These detailed advisories contain recent field observations, mountain weather forecasts and an avalanche danger rating that can assist everyone entering avalanche terrain. Our advisories are recorded every morning and can be heard by calling our hotline at 587-6981. You can also read them on our Web site at www.mtavalanche.com, or you can join hundreds of others who get the advisory by e-mail every morning. You can sign up for this subscription service on our Web site, and best of all, it's free.

The start of winter is my favorite time of the year. I won't let my eagerness cloud my judgment, and neither should you. Remember, a small mistake now can have lasting consequences. ◆

CAVE NOV 2002

AVALANCHE ADVISORY

Daily report from the Avalanche Center is a useful tool for making wise decisions in the backcountry

Doug Chabot can be reached at 587-6984 or at dchabot@fvfcd.us.

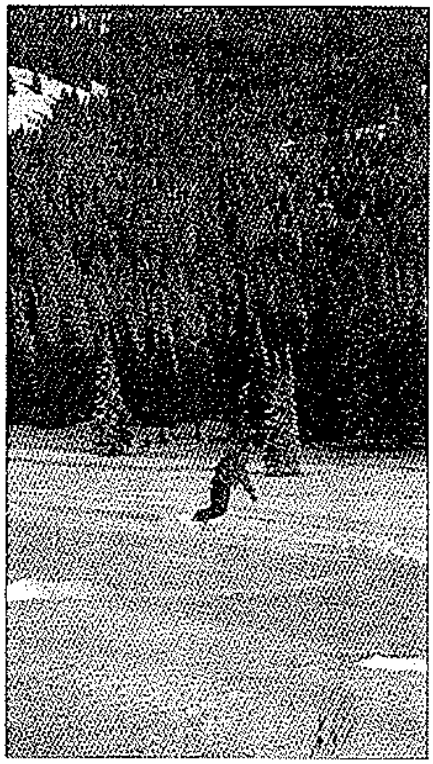
Let's face it, unless you work outside in the snow every day, it's difficult to keep track of all the changes happening within the snowpack. Can you really remember how hard the wind was blowing last Tuesday, or if a new weak layer was buried with the last snowstorm? Probably not, and that's where we come in. We dig snowpits, make field observations of the avalanche conditions for you, and then write about it in a detailed one-page avalanche advisory that you can easily get via phone, web or e-mail. Additionally, this document will let you know if people are triggering or getting caught in slides, and tell you where and how much it snowed. It's designed to help you make timely and informed decisions about whether to ski or ride a slope, and best of all it's free.

The creation of the advisory begins at 4:30 every morning. With the streetlights still blinking, either myself, Ron or Scott arrive in the office to begin researching and writing. Our goal is to have the advisory out by 7:30 am so you'll be armed with the latest weather and snowpack information as you head out the door. Needless to say, the ease of composing the advisory is directly proportional to the strength and quantity of coffee we drink.

The first section of our advisory consists of a weather paragraph. Usually we begin by stating the obvious; did it snow, and if so, how much? Most of the time we extrapolate from the weather stations at the ski areas and remote Snotel sites scattered throughout the backcountry. This data is then verified with the ski patrols, since they're early risers too. Once we identified where and how much it snowed, we look at the weather models to create a 24 hour mountain weather forecast covering snowfall, wind and temperature trends. We'll tell you where the best powder can be found and how bundled up you'll want to be. Finally, we seek advice from a meteorologist at the National Weather Service before wrapping up this section.

The next part, the snowpack and avalanche discussion, is the meat of the advisory. I enjoy writing this segment since it details everything we've been seeing out in the backcountry. On most days we're outside with a partner hunting around for unstable snow conditions in order to get a handle on the avalanche danger. We concentrate on popular areas and spend our days skiing and snowmobiling in the backcountry digging snowpits and performing stability tests. Like detectives, we search for clues to the snow stability and question how it may change by tomorrow's forecast. We're always asking ourselves, "What will happen if it snows a foot tonight?" By wrestling with hypothetical scenarios, we minimize overnight surprises.

Our advisory area is quite large and encompasses the Bridger, Gallatin and Madison Ranges, the Lionhead area near West Yellowstone and the mountains around Cooke City. With over 3,500 sq. miles to cover it's physically impossible for us to test the snow daily in all locations, so we rely on a network of skiers and snowmobilers to send us their field observations in order to fill in the blanks. We condense their findings, along with our own and add it into the advisory.



Jason Backholtz

Skiers, boarders and snowmobilers should always call the avalanche advisory before heading into the backcountry.

We try and make our discussions educational by filling it with examples and lessons about snow structure and stability. For example, we'll tell you if we saw any avalanches or other signs of instability, or if there are wind slabs lurking about, and we'll give you a heads upon as to whether certain layers in the snow are getting weaker or stronger. Besides the narrative text, stories, data and examples, we conclude with an very succinct "Avalanche Danger Rating". This rating is a synthesis of the entire advisory that's boiled down to a few sentences describing the overall likelihood of either seeing or triggering a slide that day. We use descriptors like low, moderate, considerable, high or extreme to define the conditions you can expect to find.

Once the advisory is written we e-mail it to everyone on our subscription list, put it on our web site and record it on the phone lines. Last year 1,500 people a day accessed these advisories, so if you're missing out, it's not too late to start getting them. You can call our hotline at 587-6981, read it on our website www.mtavalanche.com or subscribe to our email service there too.

Most of us play in avalanche terrain, and no matter if you ski, board or snowmobile, you constantly have to assess the slopes stability in order to minimize your risk to avalanches. Getting the avalanche advisory should be part of your trip planning since its full of pertinent weather, snowpack and stability information. It's just one more useful tool to help you have fun and be safe. ◆

CARVE DEC 2002

AVALANCHE ANATOMY

Knowing the four key ingredients of an avalanche will help you evaluate stability in the backcountry

Doug Chabot can be reached at 587-6984 or at dchabot@fs.fed.us.

Avalanches involving people don't happen randomly. In 95% of avalanche incidents, the victim, or someone in their party triggers the slide. We place ourselves in harms way for recreation, so it's a good idea to understand what's happening with the snow so we can play safely in avalanche terrain.

Almost all of the avalanche deaths in North America are attributed to dry slab avalanches. A slab is a cohesive mass of snow that slides on an underlying weaker layer. The reason dry slab avalanches are so dangerous is because they allow us to get out in the middle of the slope before they fracture, catching us off guard, usually as we're too far onto the slab to avert disaster. Imagine walking up an inclined roof when all of a sudden the shingles peel off simultaneously. With your footing gone there's not much you could do, except log some airtime and hope for the best.

Most avalanche fatalities happen on slopes with less than 300 feet vertical drop. For reference, that's smaller than a football field, yet they can still be quite forceful and deadly. Avalanches accelerate quickly and after just a few seconds the slab can reach speeds over 80 mph, which doesn't leave you much time to react. Additionally, the weak layer under the slab can propagate at over 200 mph appearing to fracture the slab all at once, resembling a pane of shattering glass. Besides the speed, you've got the tonnage of the slab moving along with you. With force like that, it's easy to see why getting caught is a bad idea.

In order for us to produce an avalanche, we need four key ingredients. If any one of the four is missing, we won't get an avalanche. Being safe is all about timing.

The first and most important ingredient is avalanche terrain; an open slope between 30 and 50 degrees, usually the perfect steepness for making turns or highmarking on. The second ingredient is a slab of snow; a relatively harder, denser and more cohesive layer than the one underneath it. The third ingredient is a weak layer. The weak layer sits below the slab and causes it to break apart and avalanche when it fails. And last, but certainly not least, we need a trigger to tip the balance of the slope. Natural triggers could be more snow, wind, rain or cornice falls, although we're most worried about human triggers since we're the ones releasing the avalanches that kill us.

There are many times during the winter when dry slab avalanches can be on the brink of fracturing. Much like the "straw that broke the camels back", the weight of a person can sometimes be enough to initiate a fracture. This is because weak layers can be sensitive to stresses that are applied quickly, like a cornice breaking off or the combined weight of a snowmobile and rider or skier. If the weak layer is widespread and touchy the slab will be precariously supported, on the verge of avalanching, almost waiting for someone to trigger it. Spooky indeed.

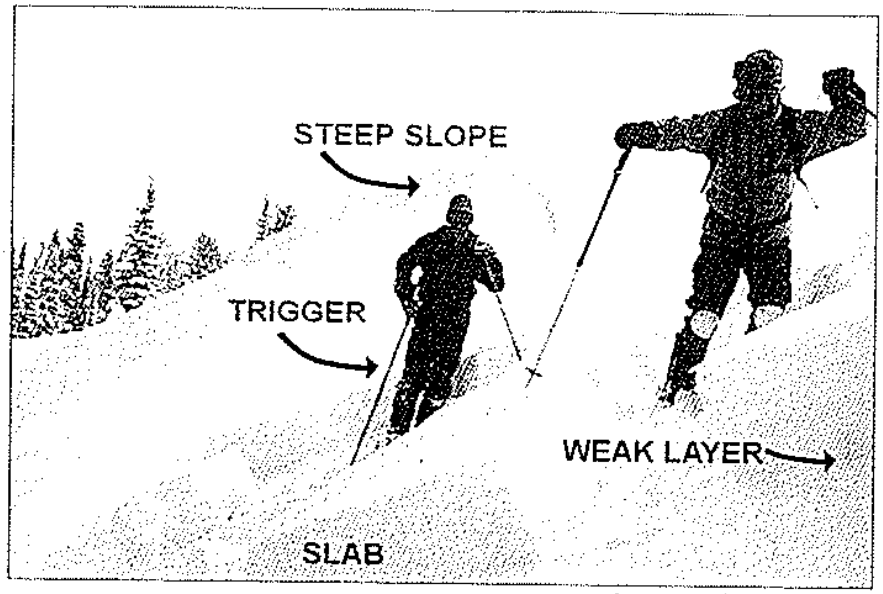


Photo courtesy of the Avalanche Center

Knowing the four ingredients of an avalanche will help you stay safe while trekking through the Montana backcountry.

Most of us choose to play in avalanche terrain, so right off the bat we've got two of the four ingredients: a slope steep enough to slide and a trigger, us. Lets take a look at the other two.

Every time it snows, a new layer is formed in the snowpack. The weather during the snowstorm and while it's on the ground affect the snow differently. Warm weather can create denser layers, the sun can form ice crusts and cold clear nights can form surface hoar. As these layers get buried in future storms, some of them are stronger or weaker than others and it's the relationship between these layers that determine the avalanche danger. When a relatively stronger layer overlies a weaker one, we have a slab. Typically, pictures of avalanche debris show big blocks that look very dense and hard. Certain slabs, like those densely packed by the wind, resemble cement blocks, but many are quite soft. For an avalanche, we need a slab of snow that's relatively stronger than the snow underneath. Sometimes even powder can fracture and act as a slab if it's sitting on something even weaker than itself.

Weak layers are a major piece in the avalanche puzzle, yet they can be tricky to identify. After investigating numerous avalanches we've repeatedly seen the same types of weak layers fail and fracture. Surface hoar is one of the top performers. This frozen dew forms feathery crystals that become persistent weak layers once they're buried. The same goes for faceted, angular crystals that look and feel like sugar. These are formed near the surface by strong temperature gradients in the snowpack, and are cohesionless and poorly bonded. A good test is to try and make a snowball with a handful of them. It doesn't work. It's worth your time to really be on the lookout for these two layers, because in southwest Montana they're responsible for over 90% of human triggered slides!

These avalanche basics are a first step in trying to answer the question "Can the slope slide?" Does it have the four ingredients, or not? Perhaps it already has three of them, but is missing the fourth...you. Remember, whether a slope avalanches is all about the timing, or convergence of these ingredients. Trying to figure out the stability of a slope can be complicated, and that's where we can help. Call us at 587-6981 to hear the latest avalanche advisory, or check us out on the web at www.mtavalanche.com to read or subscribe to it. ◆

CARVE DEC 2002

AVALANCHE MYTHS

Dispelling some common myths that can lead to a false sense of security in the backcountry

Doug Chabot can be reached at 587-6981 or at dchabot@fs.fed.us

I hear the wildest things. People call up the avalanche center and tell us their tales of near-death, during classes students share their adventurous avalanche experiences, and even standing in line at the coffee shop, java junkies will freely tell us their exploits. I depend on these people to relay their outdoor experiences because usually they contain a few nuggets of critical snowpack information. Besides, we love hearing all the entertaining stories. However, occasionally laced within these stories are myths about avalanches that are false. All of us hold dear certain myths about our world, me included, like believing that caffeine isn't really a drug or that I'll cramp up and drown if I go swimming within an hour of eating lunch, a myth courtesy of my mom.

As educators, we try and dispel myths associated with avalanches. Let's look at some of the more common ones, because if we can learn the truth, then we can make better decisions about traveling in avalanche terrain.

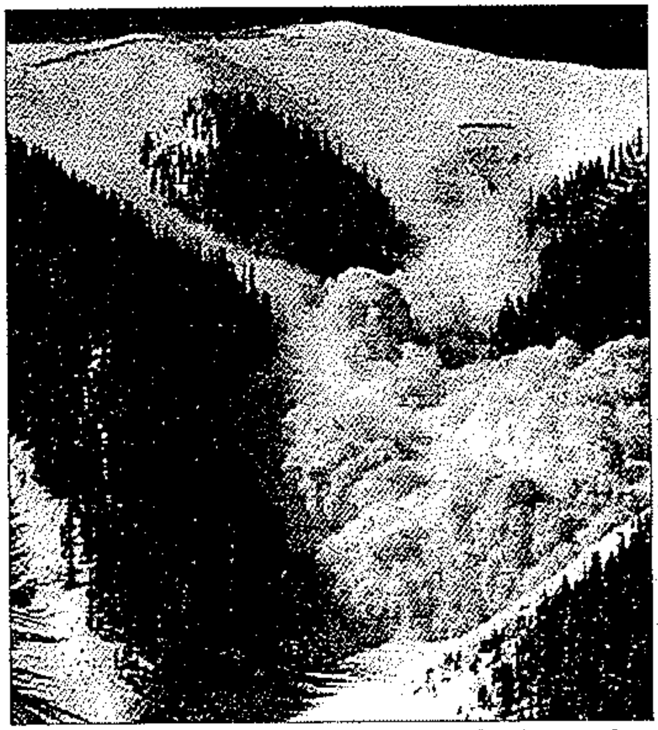


Photo Colorado Avalanche Center

This photo was taken by Tim Lane on February 28, 1987, at Red Mountain Pass, Colorado.

Avalanches strike without warning.

In 90% of avalanche accidents, the victim or someone in their party triggers the slide. They're not hapless victims. Avalanches usually are preceded by obvious signs of instability, like previous avalanches and collapsing or cracking of the snowpack. Unlike earthquakes, which strike with little warning and effect innocent people, avalanches happen in specific places at particular times. If we know what to look for we can see patterns and recognize the warning signs.

I can out run or out ski an avalanche.

If luck is on your side, sometimes this is possible, but I'd hardly want to bet my life on this. Avalanches can accelerate quickly, easily reaching speeds over 80 mph. Snowmobilers certainly have better odds than skiers of outrunning a slide, but that's only if they're facing downhill and low on the slope, which usually comprises only a fraction of their time. Even with a throttle at your disposal, the odds are still not good. It doesn't matter how big an engine you have or how fast you can point your skis downhill, the avalanche accident literature is littered with burials and fatalities of folks who thought they could simply "gun it" and outrun a slide.

Tracks on the slope mean it's safe.

This is a very common, and very wrong assumption. If a slope has a widespread weak layer, it's very possible to trigger an avalanche and rip out the older tracks. One reason it's possible is because the snowpack is not uniform. There are spots where the snow is deeper than others and areas where the weak layer is closer to the surface. Imagine a buried weak layer five feet under the snow. You could probably lay some tracks and have your weight not affect it. However, there may be a spot on the slope where it's only buried two feet deep, possibly next to a rock outcropping. If you happen to slide over this area, you may easily collapse the layer, propagating an avalanche into the deeper slab thereby pulling out the entire slope. Previous tracks have lured many avalanche victims into thinking the slope was safe.

This slope never slides.

It's pretty naïve to think that just because you haven't seen something with our own eyes that it can't be true. In other words, if you've never seen a particular slope avalanche, don't think it hasn't, or can't. If the slope is relatively open, steeper than 30 degrees and has snow on, it's considered avalanche terrain and certainly can slide IF the conditions are right. Triggering avalanches is all about timing. If the ingredients for a slide are present (a steep slope and slab overlying a buried weak layer), then all that's missing is a trigger. You.

The noise of my machine triggered the slope.

This is one of the more popular myths. Noise does not exert enough force onto the snowpack to trigger a slide. If noise were powerful enough, our snowmobiles would knock us to the ground every time we fired them up. This just doesn't happen. If you trigger a slide, it's most likely due to the combined weight of you and your machine increasing the stress on the snowpack, not the noise.

If I get caught, I can dig myself out.

Once snow has avalanched, the debris sets up like concrete. Even light powder forms very dense debris because the action of sliding breaks down the snow crystals and densifies the snow. If you're caught, once the slide stops you won't be able to move a finger. Its pretty amazing how trapped and helpless you are if you're buried. There's really nothing you can do except wait for your partner to dig you out, provided you were both carrying avalanche transceivers and a shovel.

Throw out these old ideas and embrace the truth. There's no sense kidding yourself. You have no excuse to think, "Hey, lets hit this slope! It's already got tracks on it, plus it never slides anyway. Even if the noise of my machine triggers it, I can always outrun it, or if I'm really unlucky at least dig myself out." You're smarter now. ◆

AVALANCHE BURIALS

Weak, unstable snowpack leads to backcountry fatalities

Doug Chabot can be reached at 587-6984 or at dchabot@jfcable.us.

I was anticipating a nice slow start to the avalanche season. After all, December was pretty benign with hardly any snowfall. As it ended up, I couldn't have been more wrong. When we finally began issuing daily advisories around Christmas it felt like we were shot out of a cannon, going from zero to a 100 mph in a split second. Within the first few days it started to snow and we issued a Backcountry Avalanche Warning due to the extremely weak and unstable conditions. Skiers and snowmobilers were getting caught in slides, luckily without consequences, but serious nonetheless.

In some seasons we never issue an Avalanche Warning. The criteria for them are stringent. The avalanche danger must be "High" on all slopes over 30 degrees; this means that it's likely you would see natural and human-triggered slides in all avalanche terrain. This is scary stuff and we don't place the Warning lightly. Unfortunately after the first round of high avalanche danger, another weak layer got buried around New Year's. This came back to haunt us at the end of the month as more snow loaded the snowpack creating extremely unstable conditions. We issued more warnings, with a prolonged one for the mountains around Cooke City where the new snow was measured in feet instead of inches.

Since Mother Nature denied us a regular start to the season, when the snow finally fell skiers and snowmobilers flocked to the mountains making up for lost time, many of them triggered avalanches. Some people walked away unscathed, others were injured, and two people were tragically killed: a snowmobiler outside Cooke City on Jan 23rd and another in the Crazy Mountains, Feb 2nd.

As I write this at the beginning of February, we've only been putting out the daily advisories for five weeks, yet they've been busy weeks. We've heard of 30 human triggered slides resulting in 14 burials, one injury and two deaths. For comparison, last winter totaled 44 incidents with nine burials, one injury and three deaths. With months of the avalanche season left, I'm more than a little worried about the future. Although there are many incidents we never hear about, stories of burials, injuries and certainly fatalities, usually are reported.

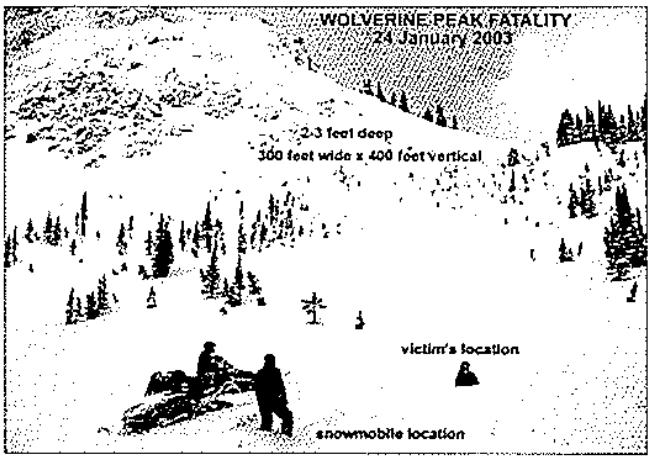


Photo Courtesy of Gallatin Valley Avalanche Center

Given weak and unstable conditions in the mountains it's not surprising to have a lot of avalanche activity, however it is disheartening to hear of people being caught in slides during times of obvious instability. Regardless of your sport or skill level, if you choose to play in avalanche terrain you're accepting a certain level of risk no matter what the avalanche danger. And the risk of being caught or killed in an avalanche increases drastically if you decide to play during times when we know the danger is bad. As an example, I like kayaking which carries a certain amount of risk. However boating during flood stage is even more dangerous. A rising avalanche danger is analogous to a river overflowing its banks. It becomes more difficult to maintain control.

The 30 human triggered avalanches this season are evenly split between skiers and snowmobilers at 15 each. Five skiers have been caught resulting in three partial and one full burial, while twelve snowmobilers have been caught, partially burying four and completely burying eight with one injury and two deaths. Between the two groups that's a lot of buried people. Some were found out of sheer luck-a fortunate stab of the probe pole has saved at least one, and many had an arm or hand sticking out of the snow. Many more were rescued by their partners using avalanche transceivers, while passing parties who just happened to witness the slide saved others.

Multiple burials are the scariest and most difficult to rescue. Three of the snowmobiler incidents and one with skiers involved more than one person. It's important to expose only one person at a time to avalanche terrain because this allows the most number of people possible to be available for a rescue in the event you made an error and triggered a slide. If more than one person is caught, or God forbid everyone in the party is buried, the chances of everything working out OK dwindle proportionally.

We should use these incidents as a reminder to treat the backcountry with respect and realize that avalanches are a very real threat. Our brains are the most effective tool we carry out there, and getting avalanche education can sharpen our minds to make good, safe decisions. Carrying the proper rescue gear like a transceiver, shovel and probe, is also essential. There are many people alive today because they carried this gear, but remember rescue doesn't always work. That's why playing in avalanche terrain carries risk; it's impossible to be 100% safe or 100% correct. Our daily advisories can help you minimize your chances of getting caught in an avalanche by informing you of general patterns of instability; where it snowed, where people have triggered slides, and what to look out for. You can get these advisories by calling our hotline at 587-6981, by logging onto our Web site at www.mtavalanche.com, or by subscribing to our e-mail service on the web. Our Web site also allows you to keep tabs on the weather and avalanche history, as well as read about the most recent avalanche incidents. The photo of the Wolverine accident that happened outside Cooke City is an example of the type of detail you can expect to find. We believe that the more information we give you, the safer you'll be. ◆

CARVE FEB 2003

AVALANCHE SAFETY

Lessons learned from unstable snowpack

Doug Chabot can be reached at 587-6984 or at dchabot@fs.fed.us

This winter was rare season of very unstable snow. During one stretch we heard of human triggered or natural avalanches 28 out of 32 days; one of the more prolonged runs of activity we've ever had. As an avalanche specialist this avalanche cycle was a double-edged sword.

On one hand it was nerve wracking as we spent countless hours grappling with the complex layers in the snowpack. On the other hand, it was exciting and adrenaline filled since we saw avalanches being triggered and got to investigate wildly unique and unstable slopes.

My learning curve looked like the Dow in the mid 90s, steep and uninterrupted. Every day I went outside I learned or saw something new. I was constantly surprised—whether it was an avalanche in an unusual location, or snow so weak that it collapsed and cracked around me. I learned some new lessons and got a few old ones pounded further into my tiny brain.

One important lesson that many people learned this year is that luck can certainly work to your advantage, but being prepared is a much better option. This advice works great in other areas of our life too, but from an avalanche perspective it can be lifesaving. In January a person was completely buried in a slide, and only the lucky stab of a probe pole saved his life. In other incidents a hand or leg was poking out of the avalanche debris, its victims saved by passing parties since they lacked rescue gear. If you're bored with life, relying on luck like these folks can certainly spice it up, but I prefer to have the deck stacked a little more in my favor. My partners and I carry avalanche transceivers, shovels and probes as a backup to faulty judgment.

Another point driven home is that we shouldn't ignore signs of instability. Recent avalanches, especially ones that you may have triggered, are sure-fire indicators that the snow is unstable. There's no need to dig snowpits and test anything; Mother Nature just gave you a free clue. Imagine cruising down the highway seeing cars spin 360s and pile up alongside the road. You don't need to stop and see if the road is icy, right? It's the same with avalanches.

Another valuable point is that you shouldn't put too much faith in stability tests when there are other signs of instability out there. A few times this winter we dug our snowpits and tested the snow, getting results that led us to believe the snow was getting stronger. Yet soon afterward we triggered the slope. These false-positive test results illustrate a few things. First they confirm that stability tests are good at telling you that the snowpack is unstable but not that it's stable unless there's lots of evidence corroborating it. And second, they show us that tests like this are just one of many pieces of information we need to listen to. It's certainly a valuable piece, but taken alone it becomes worthless.

Rod Newcomb, who's been an avalanche instructor for decades, says that you can never trust buried layers of faceted snow crystals. This year we're proving this statement true. Facets are angular snow grains that bond poorly together forming persistent weak layers in the snowpack. Layers that formed at Thanksgiving were failing in February creating destructive avalanches.

Once buried, these facet remain persistent and problematic. They're the main reason we'll notch back our activities a bit and take the conservative approach. Since they're deep, weak and widespread, if an avalanche is triggered it can be large and deadly. Additionally, the deeper they get the harder it becomes predicting if a given slope will slide.

Photo courtesy of the Avalanche Center

Doug Chabot inspects the snowpack in the Montana backcountry. Knowledge of avalanche danger and carrying proper equipment will help reduce risks on backcountry slopes.

As an example, this February the Bridgers got hit with many snowstorms, dumping almost 70 inches in a week. Even though this was a lot of snow there was very little avalanche activity. Then it snowed only a few more inches with a little wind, by itself nothing remarkable, but a widespread avalanche cycle ensued an a layer of facets. The snowpack was brought to the brink, and this small snowstorm triggered the cycle. With this much new snow in such a short period of time we knew the avalanche danger was high, but it was impossible to predict that just a tad more would trip the scales. Situations like this don't happen often, but when they do I sit up and take notice.

These lessons are valid any year, but this season they were hammered home. A winter like this one forces us to have an open mind and encourages us to be humble and conservative. Remember, the backcountry can surprise us, so make sure you give yourself enough wiggle room for making mistakes. ◆

CAIUC March 2003

Basic Avalanche Awareness Workshop

The ASMSU Outdoor Recreation Program will sponsor a Basic Avalanche Awareness Workshop presented by Gallatin National Forest Avalanche Center instructors Ron Johnson and Karl Birkeland.

The workshop will be held Wednesday, Dec. 4 and Thursday, Dec. 5 from 7 to 9:30 p.m., at MSU in the Strand Union Building. A field session will be held on Saturday, Dec. 7 at Bridger Bowl. Topics covered will include: avalanche terrain recognition; the effect weather has on avalanche hazard; the development of the mountain snowpack; decision making skills; and basic search and rescue procedures.

Participants in the field session should have basic skiing and snowboarding skills, and the appropriate equipment to negotiate "groomed" intermediate ski runs. Though not required, an avalanche rescue beacon will be very helpful for the field session.

Cost is $5 for each evening session and $15 for the field session. Cost for the entire workshop is $25. Registration is not required for the evening sessions. Registration is required for the field session, which can be done at either of the evening sessions. Contact the ASMSU Outdoor Recreation Program at 994-3621 for more information.

Avalanche Awareness for Snowmobilers Class

This week the Gallatin National Forest Avalanche Center, in partnership with Team Bozeman, will be offering an Avalanche Awareness class tailored specifically for snowmobilers. Two evening lectures on Thursday and Friday, Dec. 5 and 6 and an all day field session on Sunday, Dec. 8, will cover weather, terrain, avalanche formation, rescue, stability tests and rider safety.

Participants need to register in advance by calling Team Bozeman at 587-4671 and have access to a snowmobile for the field session. A suggested donation of $30 will benefit the Friends of the Avalanche Center.

Big Sky Weekly 11/29/02

Avy Science

Safe Travel in Avalanche Terrain

by Lance Riek and Ronald F. Johnson

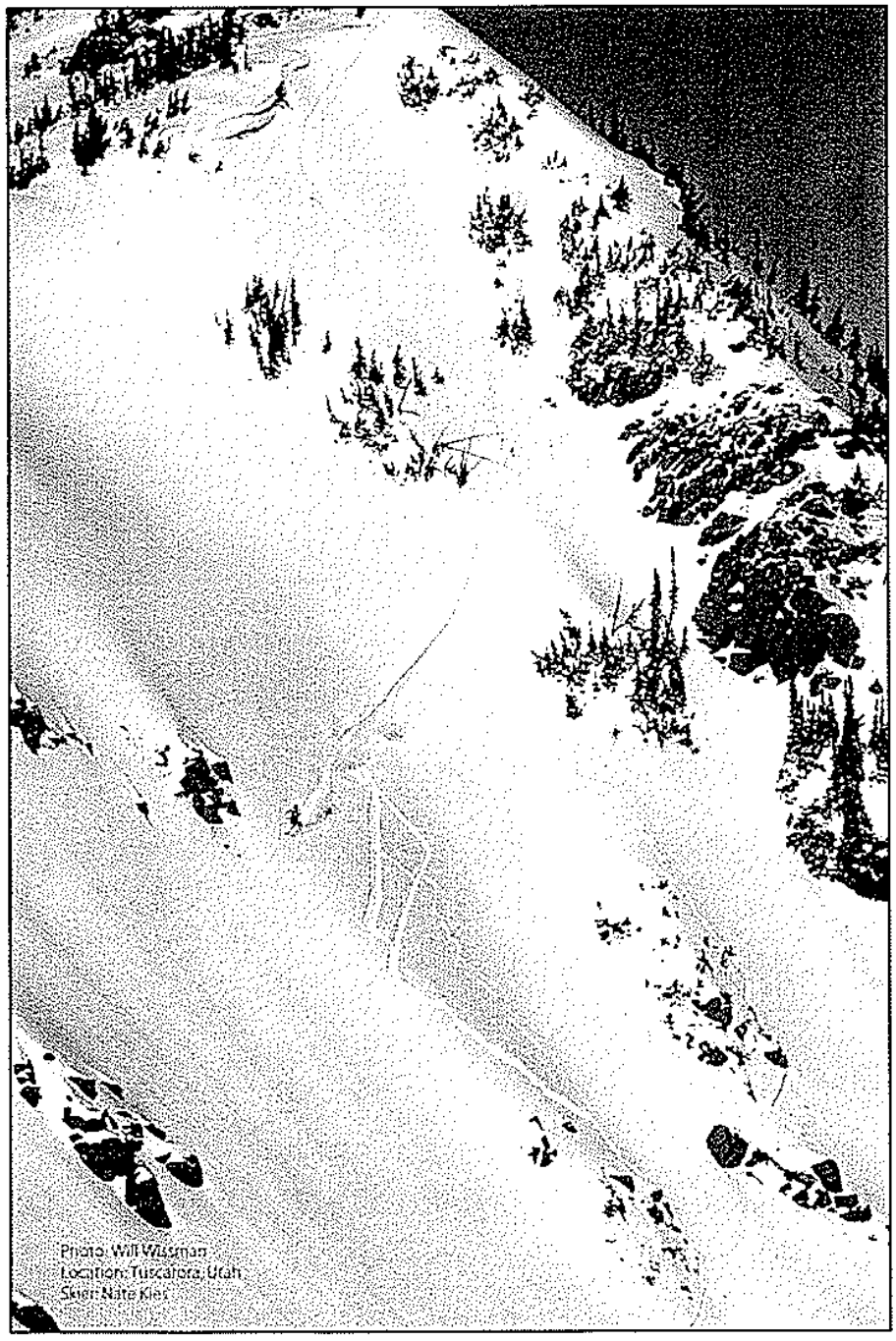


Photo: Will Wissman
Location: Tuscarora, Utah
Skier: Nate Kiel

The recorded avalanche advisory usually ends, "even in periods of low avalanche danger, avalanches are still possible; backcountry travelers need to use caution and expose only one person at a time when traveling in avalanche terrain." Spoken so often by educators and forecasters, these words seem to lose their meaning with repetition.

Regardless of the forecast, using safe travel methods reduces the likelihood of being caught in an avalanche. If done religiously, employing safe travel protocol can virtually eliminate the chance of more than one person being caught. If more than one person is buried in a small team, at least one is likely to die.

It is important to take precautions every time you're in avalanche terrain. To achieve this, develop a set of travel habits, which will eventually become a travel ritual. Without a ritual, it's too easy to forget something or become sloppy.

One of the key ingredients to maintaining safety is to keep your mind alert to dangers. Always assess your travel decisions by asking, "What if?" type avalanche questions. What if this slope avalanches? Will I be caught? Will my partner be caught? What will I do if I'm caught? What will I do if my partner is caught?

The following safe travel suggestions do *not* lessen the need for evaluating snow stability. The scope of this article does not include evaluating stability, digging pits, and conducting stability tests. The travel considerations presented here only reduce your chances of being caught *after* you have carefully decided that the avalanche hazard presents an acceptable level of risk for you and your group.

Check equipment and batteries

The first step of the ritual is to check that your beacon, probe and shovel are in your pack before you leave home. Batteries are not that expensive and it's not worth trying to squeeze one more tour from an old set. Manufacturers recommend only alkaline batteries; rechargables are not recommended because the different voltage discharge characteristics render the on-beacon battery check unreliable. You could begin your tour with a seemingly fully charged battery only to have it go dead by lunchtime.

"If more than one person is buried in a small team, at least one is likely to die."

Check beacons

Turn on your beacon at the trailhead and check transmit and receive functions for all beacons; it's too easy to forget later. The following suggested method only takes a couple minutes. The first person skins away from the parking lot with his beacon transmitting. The others check his transmit and their receive capabilities. After the first is beyond the range of the receivers, he stops and switches his beacon to receive. The remaining group turns theirs to transmit. The second skins towards the first person. The first skinner checks his receive mode, and that the second, moving beacon, has sufficient transmission power. The second person continues past the first up the trail. As the second moves out of range, the third begins to move towards the first. Repeat for the rest of the group.

Carry a probe

Use dedicated probes, they work better than ski poles. They assemble more quickly, probe deeper, cut through dense debris more easily and stay together more reliably.

Stow your shovel so that it's easy to grab and put together. If you fasten it to the outside of your pack, make certain is securely attached and can't be dislodged by a fall or tree branche.

Remember to ask, "Do I have all of my avalanche gear, is my beacon transmitting, are my partners' beacons on and working?"

Practice with all your gear

Before you venture into risky terrain, practice with your beacon, probe and shovel in a realistic scenario. Instead of searching for a beacon in a field of grass, practice finding a deeply buried beacon inside a backpack. Begin with your beacon under your jacket, and your probe and shovel inside your pack. What matters is shaving seconds off the whole process—from being dressed and packed as you would be for descending, to uncovering the buried backpack.

If caught in a slide, your equipment can drag you under. Don't wear pole straps when in avalanche terrain. In a big slide, releasable bindings could save your life. If you have non-release bindings, think about how you might be able to undo them by hand if caught in a large slide, and don't use safety straps. Most avalanche experts advise retaining your pack if caught in a slide. It can protect your spine, and you may need its contents.

Safe travel protocol

Call the avalanche advisory. Most backcountry areas are covered within a local avalanche forecast. Use it. The professionals who compile the snow data and issue the forecasts know what's going on inside the snowpack. In a general sense, they can inform you about what to look for, what instabilities exist and on which slopes and where to find the best sliding conditions. Following the advisory regularly, even when not planning a trip, will help to develop a sense of the evolution of the snowpack and the hidden weaknesses.

Recognize avalanche terrain

The first step to managing safe travel is recognizing avalanche terrain. All slopes 30° or steeper, unless covered with dense trees, can slide. However, slides can start on an open slope above and run into dense trees. Additionally, low angle slopes in the run out zone of avalanche paths are also avalanche terrain. Slides can be triggered remotely from the low angle slope; possible to trigger an avalanche in just the wrong spot due to variability in the snowpack. So, as always, descend one at a time while the rest of the group stays in a safe location, top or bottom.

It's important to be able to see your partners descending the slope (so you can track them if they're caught in a slide), but it's more important to wait in a safe location. On longer, complex slopes where the entire line is not visible, consider whether the first should stop at a SAFE spot, off the path, where he can see the whole path above and below. When descending wider slopes, choosing a line on the side makes it much more feasible to escape. Think, "If I trigger this slope, what is my escape route?" If you're center punching a wide slope and a big slab cracks loose, you'll probably ride it to the bottom.

Move to safety at bottom of run

At the bottom of your run, get out of the way, really out of the way. This seems simple, but also seems to be one of the most commonly violated tenets. At the bottom ask, "How far would it run if the next guy triggers the slope?" After your descent, be mentally prepared to rescue a partner who might become buried part way up the slope.

Summary

Your team needs to carry avalanche equipment and have experience using it. They also need to monitor whether you are entering avalanche terrain and avoid it, if possible, during the climb. They need to watch for signs of instability such as avalanches and cracking and collapsing of the snowpack. After you have assessed the stability and have decided the risk is acceptable, your team needs to choose the safest route through the avalanche terrain and expose only one partner at a time both climbing up and sliding down. To stay alert to potential dangers, you need to continually ask the question "What if...?," to avoid slides and to be prepared should something rip.

Though this article may seem like a preachy, sermon-like list of things to do or to avoid, a safe travel ritual is much more than just checking off items on a list. Not all situations can be handled by a list. These ideas represent general guidelines for you to consider and use. Carefully weigh your travel decisions and work to develop a sense of likely outcomes and potential consequences from those decisions.

Ron Johnson, an avid backcountry skier, has forecasted for 10 years at the Gallatin National Forest Avalanche Center (GNFAC) in southwest Montana. For 20 years, he has instructed courses for a number of schools including the National Avalanche School, the American Avalanche Institute and the Alaska Mountain Safety Center. He conducts snow and avalanche research through the GNFAC. He has triggered countless slides while patrolling at Bridger Bowl.

Lance Riek teaches avalanche education with the GNFAC. He assists as a field partner and with the collection of snow data, both for daily forecasts and avalanche research. He has written several magazine articles on avalanche safety.

Vol. XX www.earnyourturns.com Issue 1

Enterprise file photo

Ron Johnson, a specialist from the Gallatin National Forest's Avalanche Center, teaches students how to read the layers of a snow pit for avalanche danger at Bridger Bowl in February 2001.

Avalanche of information given out at Gallatin center

By Jason Lehmann
Enterprise Staff Writer

It was another busy year for the Gallatin National Forest Avalanche Center, which provides avalanche advisories and education for outdoor recreationists.

GNFAC has grown from a one-man operation with a single phone line to an organization whose advisories were accessed over 174,000 times by phone, e-mails and the GNFAC Web site.

"We've reached more people than ever before through our advisories," GNFAC Director Doug Chabot said in its annual report. "Every year our goal is to build upon the previous season, and (last) winter was very successful."

Advisory access increased 16 percent from the previous year and a whopping 370 percent from just five years ago.

Ron Johnson, one of GNFAC's three staff members, said outdoor enthusiasts are becoming increasingly aware of its Web site, and its e-mail subscription service has helped as well.

"More and more people are aware of the product," Johnson said. "E-mail advisories has been the most convenient way for people to access our advisories."

Keeping up-to-date on avalanche conditions has become paramount for many back country recreationists, who use the information from the reports when deciding where to go.

"(The advisories) are consistently the best tool I have found to help in my evaluation of the conditions I ski on," said Warren Bauder, of the Montana Telemark Corporation.

Many other recreationists, particularly snowmobilers, would do well to take heed of the advisories, considering that last winter Montana led the nation, and set a record, with nine snowmobiler deaths due to avalanches.

Of the 32 avalanche fatalities nationwide, 18 were snowmobilers.

"Over half the people killed in avalanches this year would be alive today if they had exposed only one rider at a time on a slope," Chabot said, pointing out that all of Montana's snowmobile fatalities had "glaring similarities we're trying to point out in our education programs."

GNFAC spent 202 hours educating more than 2,700 people last year, including a stint at the National Avalanche School, which drew more than 200 avalanche professionals to Reno, Nev. for the five-day seminar.

Johnson said GNFAC will continue its education efforts, which are especially important this year because a slow snow season isn't necessarily a safer one.

"The big concern for us is when there isn't much snow, people think there isn't much avalanche danger, and that's not true," Johnson said.

This season's snowpack is about 50 percent of normal, Johnson said, and is relatively unstable, primarily near West Yellowstone.

In addition to stepping up its education efforts, GNFAC will also offer classes specifically for snowmobilers.

"Taking these classes helps recreationists understand more about avalanches, and it also helps them use the advisory more effectively," Johnson said.

On the Net:
Gallatin National Forest Avalanche Center: http://www.mtavalanche.com.

What is an Avalanche Center

By RON JOHNSON
Avalanche Specialist
Gallatin National Forest
Avalanche Center

There are three avalanche centers in Montana. There are located in Bozeman, Missoula, and Kalispell. This article will try to answer these questions: Who administers the avalanche centers? What are the different types of avalanche centers? What services do avalanche centers provide? How do you contact your local avalanche center?

Who administers the avalanche centers?

The United States Forest Service administers the avalanche centers. The staffs of each avalanche center are U.S. Forest Service employees. Though the Forest Service administers the avalanche centers, only part of the money required to operate each center comes from the federal budget. Significant funding comes from various partnerships, grants and local non-profit "friends organizations." This mix of federal, state and local funding means that each avalanche center is part of the local community. Local grass root support is essential for the viability of each avalanche center.

What are the different types of avalanche centers?

The U.S. Forest Service defines four types of avalanche centers. Montana has two types of avalanche centers. The type of avalanche center is based on a number of factors including the number staff and the number of avalanche advisories issued each week.

The Gallatin National Forest Avalanche Center, based in Bozeman, is a Type 1 avalanche center. Avalanche advisories are issued daily. Three full time avalanche specialists work at the center.

The Glacier Country Avalanche Center, based in Kalispell, and the West Central Montana Avalanche Center, based in Missoula, are Type 3 avalanche centers. A mix of full time and part time avalanche specialists and observers staffs them. Advisories are issued one day a week at the West Central Montana Avalanche Center and twice a week at the Glacier Country Avalanche Center.

What services do avalanche centers provide?

First and foremost, avalanche centers provide avalanche education programs. These programs vary from one-hour basic avalanche awareness presentations to multi-day advanced avalanche courses that include field sessions. Contact your local center for a listing of avalanche courses in your area.

Avalanche centers also provide weather, snowpack and avalanche information for their local area. This information is provided in avalanche advisories, net, telephone hot line, fax, or e-mail subscription. These advisories are for backcountry conditions and are applicable to all winter enthusiasts.

Avalanche advisories issued by the avalanche centers in Bozeman and Kalispell include avalanche danger levels. These descriptors rate the avalanche danger, within each advisory area, from low to extreme. It is important to remember, that the information given in each advisory is a general description of weather, snowpack and avalanche conditions. Advisories should be used as a tool to help you make your own decision about the avalanche danger on the slopes that you plan to play on or under. Please use the information provide, but use it wisely.

How do you contact your local avalanche center?

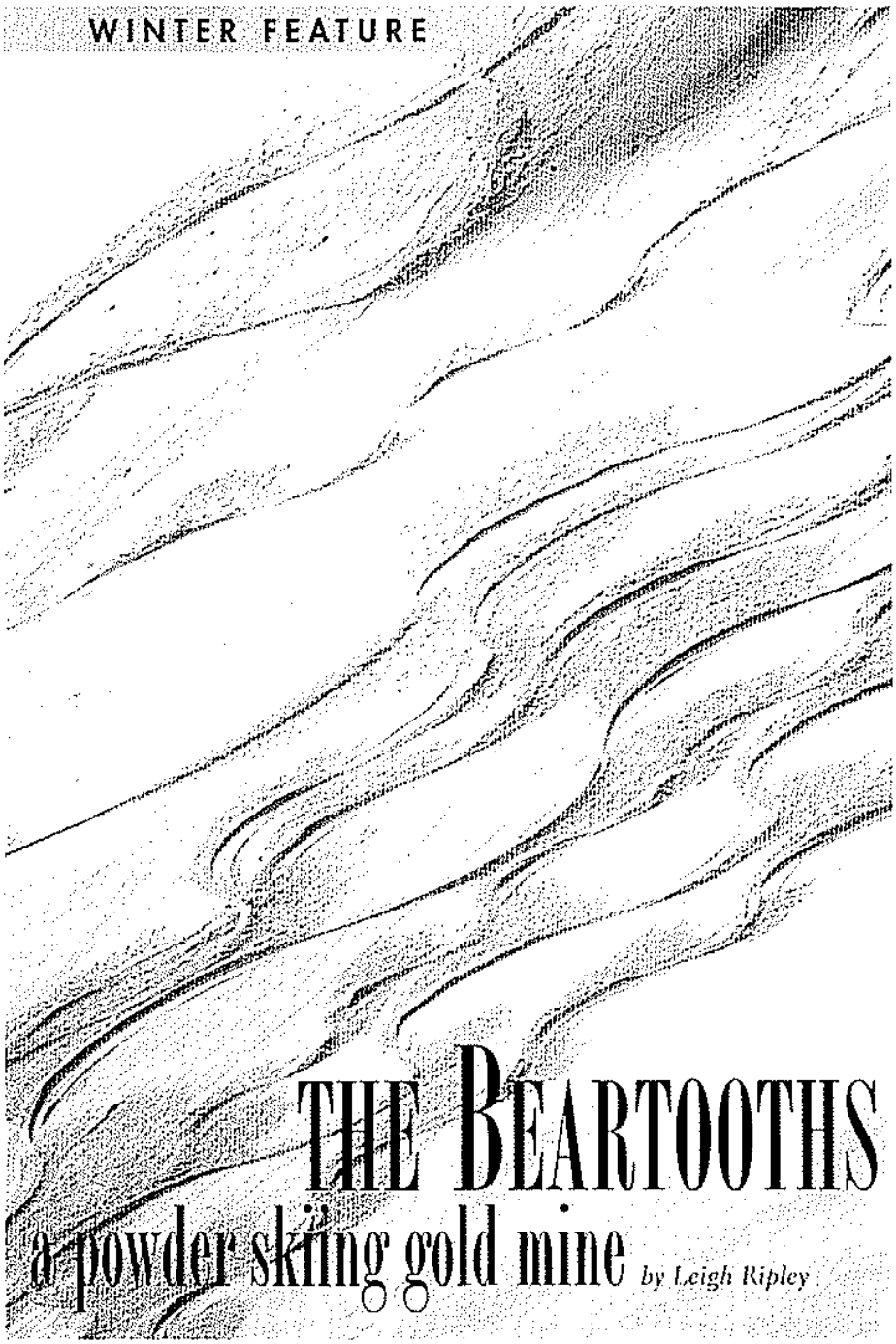
Telephone numbers and web addresses are listed below for Montana's avalanche centers:

Gallatin National Forest Avalanche Center
Phone 406-587-6981
Web www.mtavalanche.com

Glacier Country Avalanche Center
Phone 406-257-8402 or 1-800-526-5329
Web: www.glacieravalanche.org

West Central Montana Avalanche Center
Phone 406-549-4488 or 1-800-281-1030
Web www.fs.fed.us/r1/lolo/avalanche/advisory.htm

Post these numbers next to your phone or computer. Get into the habit of using the services provided by your local avalanche center. Hopefully the information provided by the dedicated staffs at each center will help you enjoy your next backcountry-riding



THE BEARTOOTHS

a powder skiing gold mine

by Leigh Ripley

COOKE CITY, MONTANA

Founded by gold miners in the early 1870s, the town had a peak population of 7,000 over a century ago. When prospector Bart Henderson struck gold the town awoke, and when the gold ceased to rush, the town went back to sleep.

Cooke City is nestled near the northeast corner of Yellowstone National Park and isolated from eastern access much of the year by the rugged Beartooth Mountains. A virtual dead-end in winter months, Cooke City's residents say the year-round population is just under 100 these days, but that statement is generally followed by a whisper, "not counting those without Social Security numbers."

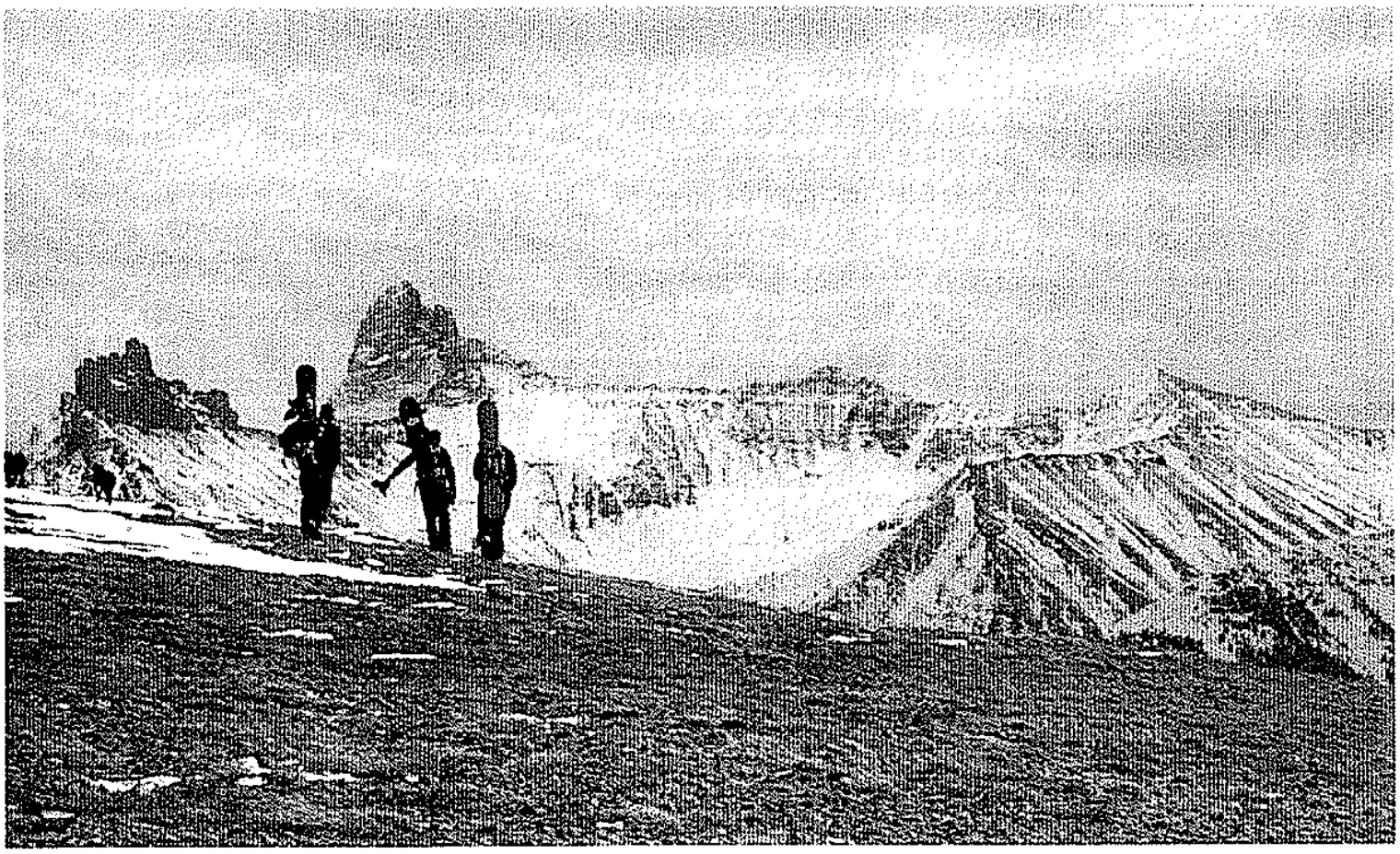
An unincorporated town, Cooke City has no law to speak of, aside from two cop cars resting on either shoulder of Highway 212 with four flat tires and permanently empty front seats. Just before winter, the cruisers are towed to safety, away from the crushing weight of the nearly 400 inches of snowfall the town will receive.

In 1988, an all-consuming, untamable Yellowstone National Park fire nearly devastated this little Rocky Mountain town. Fire spread over some 990,000 acres in the Park and close to 420,000 acres of surrounding national forest, including parts of the North Absaroka, Teton, and Absaroka-Beartooth Wilderness. In Cooke City, the fire back-burned every standing and fallen tree right up to structures on the north side of town.

When the Beartooth Highway closes in early fall, Cooke City takes a deep breath from the hordes of summer Yellowstone visitors and Beartooth Highway bikers to quietly await the snow. When winter bears down, summer residences are buried and any sign of pavement disappears for the next five to six months.

The closest developed town, Livingston, is some two hours away and for most residents of Cooke City, trips to the big city are kept to a minimum. The living is slow and amenities are limited. Each of the residents have their own reason for living in Cooke City, but all have at least two things in common: a tolerance for snowmobiles, and a love for dogs.

Dogs give people a run for their money in Cooke City. As lawless as the little town itself, mongrels have free reign of not only the streets, but the businesses as well. The only thing to outnumber dogs may be snowmobiles. At NASCAR proportions on the weekends, snowmobiles mean winter revenue and backcountry skiing in the otherwise inaccessible Beartooths. Most



PHOTOS BY DARREN JOE IRONS

locals will tell you to either use them or deal with them.

Here's the beauty of Cooke City: Everything north of town is shared with snowmobile traffic, meaning it's all easily accessible by machine. But everything south of town is wilderness—no motorized vehicles allowed—so every foot of elevation has to be gained the old-fashioned way.

Faced with the choice of riding into the higher elevations, or climbing, most people ride, leaving the south side of town untouched much of the year. Either way, you can get plenty of distance from the snowmobiles; it just takes a little effort. There are tons of places to go and more wilderness than anything else.

A small cult following has developed for skiing in the area and each year they come in small droves throughout the winter and spring. One weekend of the year, the annual Sweet Corn Festival, they come en masse. Although this year should be the 10th Annual event, no one is quite sure if it will actually take place. Sweet Corn occurs the weekend following Easter, but only if the locals feel motivated enough to put it on. If the town does pull it off, there are skiers, snowboarders, and dogs strung out from town to Daisy Pass, a favorite ski haunt north of Cooke City.

Bill Blackford, owner and operator of the Cooke City Bike Shack, has been living in Cooke City for twelve years. His shop doubles as a coffee and espresso house, as well as a backcountry shuttle and guide service in the winter. Blackford offers one-way passage into the Absaroka-Beartooth wilderness for $15 to $30 per person. Your other option is to take the heel-toe express uphill south of town.

Daisy Pass is five miles or a 30-minute snowmobile trek up and can take anywhere from one hour to a full day to descend. For most people, the day is spent working the mountains, hiking and skiing until the sun threatens to slide behind the jagged mountain peaks. When the day is done, skiers surface on a north-facing, burned-out slope called Town Hill, and ski clear through town to the Cooke City Bike Shack's door.

Blackford will take passengers as far as the Goose Lake Jeep Trail, twelve miles into the Beartooth Mountains. The snowmobile ride takes an hour and fifteen minutes, "depending on the dogs." Being Cooke City, no worthy mongrel is left behind and if they won't ride on the machine, they must run behind.

"This one dog, Wolfy, is a big huge husky-type dog who will not get on or near a snowmobile," says Blackford. "With Wolfy, it always takes twice as long to get anywhere. I usually don't charge extra for dogs, unless they are sluggishly slow. I really should start charging an extra five bucks for Wolfy."

The day I went to Cooke City, the choice was simple...I paid for a ride up to Daisy Pass. Having never skied the area, I hired one of Blackford's guides. Guides are highly suggested if you have never skied in the Cooke City/Beartooth area. Avalanches are common and the terrain is varied and unpredictable. With a good portion of the area surrounding town back-burned from the 1988 fires, the terrain looks the same from any direction. Unfamiliar skiers can find themselves easily lost and in uncompromising spots. If that were to happen, who would come looking for you? Most likely, no one. Twenty community members comprise the Cooke City Search and Rescue and proudly claim they have yet to lose a skier. But then again, how would they know you were lost?

Guides range from a half-day backcountry tour for $45 per person to a full-day tour deep in the Beartooths for $95 per person. The guide service includes a ride to the destination and guided trip down. On the descent, the guide will point out various options for getting back to town and terrain that should be avoided. The idea being, after going with a guide once, you should be able to go it alone the second time.

When winter bears down in Cooke City, summer residences are buried and any sign of pavement disappears for the next five to six months.

Blackford runs seven snowmobiles, or better yet, chariots. Large sleds are pulled by a snowmobile, capable of carrying as many as five people at a time. A large tarp is attached to the rear of the snowmobile, blocking most of the fumes and snow spray put off by the machine. To be honest, the ride was extremely comfortable.

After reaching Daisy Pass, Blackford bid us a good day and sped off. We were left to scan the area and decide which peak to climb. The clear memory of having been towed up five miles made the impending hike much less daunting. By the time we reached the ridge, we were out of sight and earshot of all snowmobiles. Dropping off a razor-thin ledge, we broke fresh tracks down a face too steep to stop. Once to the bowl, we took a necessary breather. Our guide took this time to point out various decent options while I tried to regain muscle composure in my legs. The snow was so deep each turn

Dropping off a razor thin ledge,
we broke fresh tracks down a face too steep to stop . . .
Tall, naked trees stood like skeletons against the white snow
and multiple lines of descent were clearly visible.

was made with extreme, yet glorious, effort. Each movement shot a fresh wave of powder over our heads and to stop would have meant sinking dangerously far into the powder. After what felt like an hour of bowl skiing, we took another break overlooking the back-burn near town.

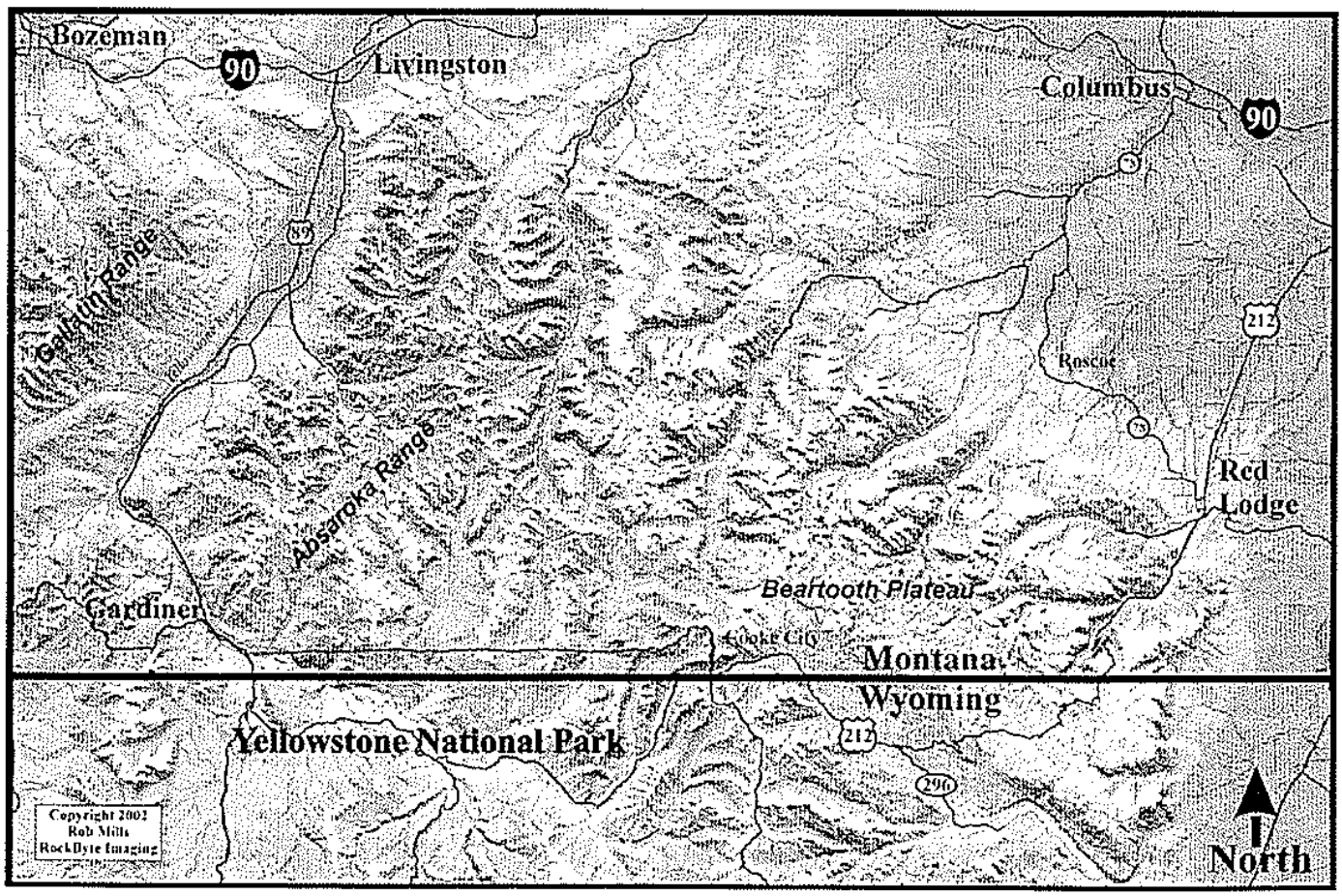
Skiing the burn was by far the best tree skiing I have ever done. Tall, naked trees stood like skeletons against the white snow and multiple lines of descent were clearly visible. After swallowing a good dose of courage we made our way down, hooting and hollering the entire way.

It was just over an hour since we had been delivered to Daisy Pass and we now stood at the top of Town Hill, overlooking Cooke City. The burn led out to Highway 212 and we skied right to the doorstep of the Miner Bar for a little grub, a few beverages, and a quick game of air hockey.

As I mentioned, once we hiked back into the Absarokas a little bit, we were free from snowmobiles. But if you would prefer the entire day away from the NASCAR circuit, go south of town and take the ascent into your own hands—or better yet, legs. The runs are clear from the front porch of the Bike Shack. Most notable are Republic Mountain's Fin, the Shoulder, and Too Tight To Tele. But no one has skied all there is to ski south of town, and most likely never will. There are several lifetimes worth of ski runs and it would be a lifetime well-spent taking on that onus.

Reservations for rides into the backcountry are suggested, but sometimes not appreciated. "If I have the choice, I may be out skiing," says Blackford with a wry grin. "I don't live here to work, you know." Either way, Blackford takes walk-ins or reservations—what he doesn't take are late people. Be on time or miss your ride. One last word to the wise, contact the Gallatin NF Avalanche Center before heading out. Better to be safe than sorry, and no one should be sorry after skiing the Beartooths. OB

The number for Bill Blackford at the Cooke City Bike Shack is 406-838-2412.



MAP BY ROB MILLS, PHOTO BY ALEXANDRE LUSSIER

AVALANCHE COURSES FOR THE 2002 - 2003 SEASON

The Gallatin National Forest Avalanche Center and the ASMSU Outdoor Recreation Center are offering avalanche seminars, basic workshops, and advanced workshops for the 2002-2003 winter season. Ron Johnson and Karl Birkeland are the instructors for both the classroom and the field sessions.

The basic class covers topics such as avalanche terrain recognition, the development of the snowpack, and the effects of weather on the snowpack. It also includes basic search-and-rescue techniques and decision-making skills. Two sessions are offered and comprise two evenings in the classroom and a Saturday session in the field. Registration is required for the field session and can be made at either evening session. The cost for the entire workshop is only $25.

The advanced class is for those who have already taken a basic workshop and want to take their skills to the next level. This class covers snowpack metamorphism, the mechanics of avalanche failure and fracture, and really emphasizes decision-making by the student. Advanced registration is required and MSU students and staff are given priority. This session costs $45.

There are also two free avalanche seminars covering basic avalanche awareness. They are one-hour-long presentations with slides, video, and discussion. The sessions will be held on December 10th at the Lincoln School in Livingston and on December 12th at the Bozeman Public Library. Both seminars begin at 7:00 pm.

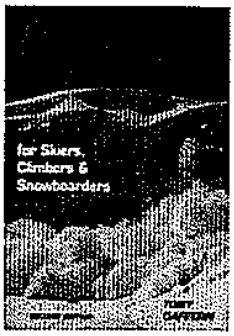
For registration or questions concerning these workshops and seminars, contact the ASMSU Outdoor Recreation Center at 994-3621.

BASIC WORKSHOPS
Dec. 4th and 5th 7-9:30 pm, Strand Union
Dec. 7th 9:30-3:00 pm, Bridger Bowl

Jan. 29th and 30th 7-9:30 pm, Strand Union
Feb. 1st 9:30-3:00 pm, Bridger Bowl

ADVANCED WORKSHOP
Feb. 5th and 6th 7:00-9:30 pm, Strand Union
Feb. 8th 9:30-3:00 pm, Bridger Bowl

—DREW REDDINGER



Avalanche Center offers awareness class designed for snowmobilers

The Gallatin National Forest Avalanche Center will be offering an Avalanche Awareness class tailored specifically for snowmobilers. Lectures on Saturday, December 14th will be held at the West Yellowstone Conference Center from noon to 5 with an all day field session on Sunday, December 15th. The class will cover weather, terrain, avalanche formation, rescue, stability tests and rider safety. Participants need to have access to a snowmobile for the field session. A suggested donation of $30 will benefit the Friends of the Avalanche Center. Call the Avalanche Center at 587-6984 for more information.

Wilder News

The Newsletter of Wilderness Medical Associates

Volume 7, Issue 1 | *Dedicated to Excellence in Remote & Wilderness Medicine* | Winter 2003

AVALANCHE RESCUE

by Ron Johnson, MS, WEMT

A winter day dawns bright and clear. A recent storm deposited 12 inches of snow. Harry and Sally are looking forward to a day of backcountry skiing. While eating bagels and drinking coffee they listen to the area avalanche advisory. The forecaster at the local avalanche center says that on slopes steeper than 35 degrees it is probable that skiers could trigger an avalanche. With that information in mind, they are on their way for a day of winter play.

An hour of climbing along a ridge brings them to the top of an awesome looking ski slope. It is steep, but it sure looks inviting. After a few minutes of debate they decide it is too good to pass up. Harry wins the round of "paper, rock, and scissors". He lets out a whoop and points his skis down the slope. Four turns later he is engulfed in a moving mass of snow. Harry is caught in an avalanche.

Unfortunately this situation occurs many times during the course of a winter. Last season 48 people were killed in avalanches in North America. These are grim statistics but it should be noted that not all people caught in avalanches are killed. The purpose of this article is to focus on the reasons people survive.

Topics covered include: What you should do before venturing into the backcountry, rescue statistics, rescue equipment, what you should do if you are caught in an avalanche, and what you should do if your partner is caught in an avalanche. It focuses on self-rescue and rescues performed by party members as opposed to rescues performed by dispatched rescue teams. Finally, only search and rescue concerns are addressed. Medical issues are addressed in David Johnson's column.

What You Should Do Before Venturing Into the Backcountry

The best way to avoid being injured or killed in an avalanche is not to be caught in an avalanche. Most avalanches occur on slopes that are between 30 and 45 degrees in steepness. These slopes are considered to be avalanche terrain, and if you don't travel on or under slopes steeper than about 30 degrees, you will probably not get caught in an avalanche. This seems simple enough, except most backcountry users who posses advanced skiing, snowboarding, or snowmobiling skills often seek slopes steeper than 30 de-

Avalanche (Continued on page 2)

The Medicine of Avalanches

by David E. Johnson, M.D.

In Ron Johnson's excellent article on avalanches he provides some data on survivability after being buried and then leaves me to pick up the pieces (no pun intended) on the medical aspects. Here goes.

The easy part relates to injuries. Someone who is found pulseless and apneic (not breathing) as a result of trauma is dead. Period. That is an easy determination when the lethal injury is apparent. In addition, a serious head injury, which may or may not be apparent, is an important mechanism because of the direct sequala as well as its impact on respiratory drive. Hypothermia and hypoxia as a result of asphyxia are two additional factors that impact survivability. Let's start with hypothermia.

Simply put, only a very small percentage of deaths from submersion

Avalanche medicine (Cont. on page 9)

The Role of Perception and Risk in Avalanche Accidents

by Dale Atkins
Colorado Avalanche Information Center

"Life is short, the art long, opportunities fleeting, experience treacherous, judgment difficult." — *Hippocrates*

On January 22, 1999 a 45 year-old Aspen, Colorado man was buried and killed in a very small avalanche he triggered outside of the Aspen Highlands Ski Area. The night before the accident the victim and a friend spoke about skiing the backcountry outside of the ski area but agreed the avalanche conditions were too dangerous. The Colorado Avalanche Information Center rated the backcountry avalanche danger at "high" and had issued an avalanche warning that both human-triggered and natural avalanches were likely. The pair decided to leave their rescue transceivers and shovels at home.

The next day the lure of fresh powder led the victim to venture outside the ski area. He completed two runs and experienced obvious signs of avalanche danger - extensive instability with cracks shooting out from underfoot and collapsing snow around him. For his third run his friend (from the night before) joined him. Neither man carried avalanche rescue gear. After leaving the ski area boundary both men experienced shooting cracks and collapsing snow. They triggered a small soft slab avalanche that buried the victim. With no rescue gear it took almost an hour to find the man.

Risk (Continued on page 3)

Avalanche (Continued from page 1)

grees. Therefore, if you choose to play in avalanche terrain it makes sense to learn about avalanches.

Jill Fredston and Doug Fesler of the The Alaska Mountain Safety Center wrote an excellent book entitled *Snow Sense*. In this book they outline some basic questions that you should seek answers to before venturing onto a specific slope. These address **Terrain, Weather, Snowpack** and **Human Factors.**

1) Is the terrain capable of producing an avalanche?
2) Is the weather contributing to avalanche conditions?
3) Could the snow slide?
4) Are you capable of and willing to make an objective assessment of the avalanche danger?

If you don't know the answers to these questions read *Snow Sense* and attend an avalanche training course.

Statistics

The data and figures used in this section were compiled by the Colorado Avalanche Information Center. They depict avalanche fatality and rescue trends in the United States from the winter of 1950-1951 to the winter of 2000-2001.

Figure 1 indicates that a person buried in an avalanche has close to a 90 percent chance of surviving if they are uncovered within 15 minutes. At 30 minutes there is less than a 50 percent chance of survival. It should be noted that 75 percent of people killed in avalanches die from asphyxiation.

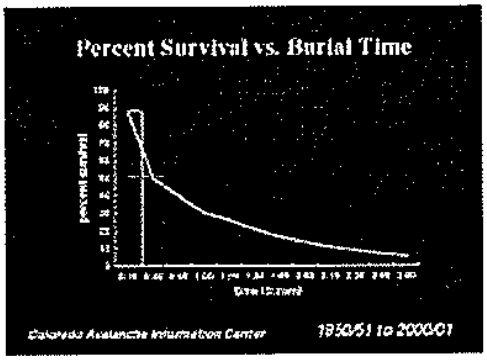


Figure 1.

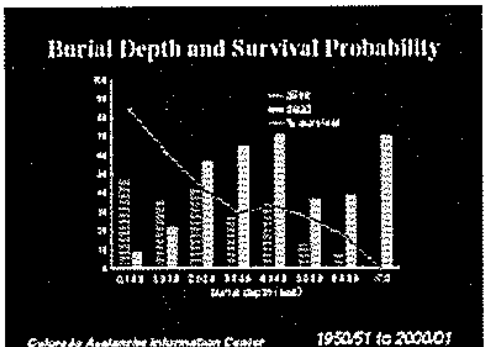


Figure 2.

Figure 2 shows that the depth of burial plays a major role in determining the likelihood of surviving an avalanche. There is little chance of surviving if buried deeper than six feet.

Figure 3 indicates that self-rescue and rescue by your companions provide the best chance of surviving an avalanche.

These statistics illustrate several key points. First and foremost, if you are not severely injured during an avalanche, you have an excellent chance of surviving if you are dug out in less than 15 minutes. Second, you will be found faster if you are near the surface of the debris. Finally, if you are buried in an avalanche, your partner(s) at the scene provide you with the best chance of being found alive. It is unlikely that a dispatched rescue team will arrive on scene in less than an hour. An exception is at or near an operating ski area.

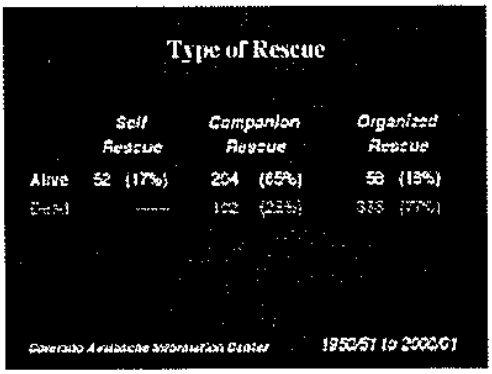


Figure 3.

RESCUE EQUIPMENT

People traveling in avalanche terrain should carry rescue equipment. Each member of the party should be equipped with at least an avalanche rescue beacon, probe pole, and shovel. An AvaLung™ should also be considered an important piece of rescue equipment. You and your partner(s) must have the appropriate rescue gear. Remember, your best chance of surviving is the ability of your partner(s) to locate and dig you out in less than 15 minutes.

Avalanche rescue beacons

Avalanche rescue beacons are transceivers that can both transmit and receive an electromagnetic field at a frequency of 450 kHz. They are about the size of a pocket mask case. Most are powered by AA batteries. Several makes and models are on the market at a cost of about $300.00 per unit. Depending on several factors, they can receive a signal from a distance of about 30 meters.

This is how they should be used. Batteries should be fresh. The beacon should be strapped to your body. Before leaving the trailhead, a check of everyone's beacon will ensure they are working properly. If someone is buried in an avalanche, the rescuer(s) should turn their beacons to receive, and, using the manufactures-recommended technique, locate the buried beacon. A properly operating rescue beacon used by a properly trained person who has practiced with their beacon provides the best opportunity for locating a completely buried person. The key is practice, and the old adage "practice makes perfect" can not be over emphasized.

Probe Poles

Rescue beacons give the location on the surface of the debris under which the person is buried. Probe poles provide the link between that location and the buried person.

Avalanche probe poles when assembled are about three meters long. They are made from aluminum, fiberglass, or carbon and can be collapsed, like tent poles, to several sections that are about 0.3 meters long. Many backcountry ski poles are designed to be converted to avalanche probe poles. Avalanche probe poles cost about $50.00 to $100.00.

Avalanche (continued on page 4)

Avalanche (Continued from page 2)

Shovel

It is not enough to locate a buried person. That person must be dug out. A sturdy, lightweight shovel is essential. This seems obvious but it is not uncommon to see people traveling in the backcountry with an avalanche rescue beacon and no shovel. This is akin to having an AED that can determine that a heart is in ventricular fibrillation but is unable to provide the electric current required to defibrillate the heart. $50.00 will purchase a decent shovel.

AvaLung™

The AvaLung™ has been available for about four years. It is essentially a breathing tube that separates inhaled air from exhaled air thus reducing the rate of carbon dioxide contamination in the inhaled air pocket. (See David Johnson's accompanying article on hypercapnea and hypoxia.) It costs about $120.00.

In order for the AvaLung™ to work, the mouthpiece must be in the mouth before burial. In a practical setting this often proves to be difficult. If you choose to use an AvaLung™, you need to practice positioning the mouthpiece .

What To Do Now That You Have The Equipment

Equipment doesn't save lives. People using equipment properly and efficiently saves lives. The key to a successful avalanche rescue is having the proper equipment and knowing how to use that equipment. So, get the gear, wear the gear, be sure it is working properly, and be sure you and your partners know how to use it effectively.

What To Do If You Are Caught In An Avalanche

The process begins before you start down the slope. Ask, what will I do if this slope avalanches? Your best chance of survival is not to get buried. If you are still on your skis or snowboard, try to get off of the avalanche by angling to the side at about a 45-degree angle. If you abruptly cut across the slope, you run the risk of being knocked over. If you decide to try to out run the avalanche you will likely be unsuccessful unless the avalanche is tiny or you can travel faster than the avalanche. Just so you know, large avalanches can reach speeds exceeding 75 mph.

If you are knocked over, get rid of your skis and poles, or snowboard. These are like anchors and they will pull you deeper into the snow. Remember the statistics, you have a better chance of surviving an avalanche if you are not buried or you are buried close to the snow surface. Swimming motions will help keep you near the snow surface. Don't be passive. As Tom Kimbrough, a colleague of mine says, "you need to fight like hell!"

Once the avalanche begins to slow down, thrust an arm toward the snow surface. Many people have been quickly located because part of them was exposed on the snow surface. If possible, place a hand in front of your face and spit out any snow. If you are wearing an AvaLung™, bite down on the mouthpiece. Once the avalanche stops, relax. Hopefully, your partner(s) will dig you out within 15 minutes. Tick, Tock, Tick, Tock.....

What To Do If Your Partner Is Caught In An Avalanche

Before your partners start down the slope ask: What will happen if they are caught in an avalanche? Where will they likely end up? How will I get down the slope? Do they have the appropriate rescue gear and is it operating? Do I have the appropriate rescue gear and do I know how to use it? The most important question to ask is: will I be caught in the avalanche? If the answer is yes, you will be a victim and not a rescuer. Watch your partners from a safe location. Addressing these questions will put you in the best position to initiate a rescue.

Your partners' chances of surviving depend on you locating them as fast as possible. Remember the statistics; their head needs to be uncovered within 15 minutes. Watching your partners as they descend the slope will help limit the search area. Locate the area on the slope where you last saw them. The search starts at the last seen point.

Switch your rescue beacon to receive and proceed with a beacon search using the techniques recommended by the manufacturer. Be sure to scan the surface of the debris for any body parts sticking out of the snow. An arm or leg sticking out of the snow means the search is over and the rescue can begin. Tug on any piece of gear or article of clothing. It may be attached to your partner's body. If there are no surface clues, continue with the beacon search until you are over the spot where your partner is buried. Get out your probe pole and shovel. Locate your partner and dig them out.

Summary

Harry yelled, "I'm caught!" He got rid of his poles and skis and tried to swim to the snow surface. The snow stopped moving. Harry had the mouthpiece of his AvaLung™, in his mouth and he knew his avalanche beacon was transmitting. He was completely buried. He waited. Tick, Tock, Tick, Tock.....

Sally saw it happen. She saw Harry get pulled under the snow about halfway down the slope. She skied halfway down the slope and switched her beacon to receive. Sally knew Harry had a beacon. They had tested each other's at the trailhead. She followed Harry's signal until she was sure he was buried beneath her feet. She probed and found Harry. Five minutes of digging uncovered Harry's head. He smiled. Harry was glad he met Sally.

Sources Of Information

Information about avalanches and avalanche rescue can be found at www.avalanche.org and www.csac.org. *Snow Sense* can be found at many outdoor retail shops or on the web at www.amazon.com WMA

Ron Johnson is a WMA lead instructor. He received a M.S. degree from Montana State University in 1983 in Earth Science. He worked as a professional mountain guide in the North Cascades, Alaska, and South America, taught Nordic skiing in Bozeman, Montana, and worked as a professional ski patroller at Bridger Bowl Ski Area. Since then, he has worked as an avalanche forecaster at the Gallatin National Forest Avalanche Center. He has instructed at several avalanche workshops, including the National Avalanche School, since 1997. He is a professional member of the American Avalanche Association and has served as chairman of that organization's Education Committee. He also works as a climbing ranger for the National Park Service at Denali as well as Grand Teton National Park.

Avalanche warning issued for mountains

A backcountry avalanche warning was issued Saturday for Montana's southern mountains, where heavy snowfall has been reported.

The Gallatin National Forest Avalanche Center said the warning includes the southern Madison and southern Gallatin ranges, the mountains around West Yellowstone and Cooke City and the Washburn Range in northern Yellowstone National Park.

"In the last 24 hours, approximately 1 foot to 2 feet of new snow has fallen in these areas," the warning said.

Given wind conditions and an unstable base for the new snow, the avalanche danger was rated high on all slopes, with both natural and human triggered avalanches likely, the warning said.

Bozeman Chronicle 12-29-02

Avalanche danger still high in region

COOKE CITY — The Gallatin National Forest Avalanche Center took the unusual action Thursday of continuing a high avalanche danger alert for the mountains around here and elsewhere in southwestern Montana.

Avalanche specialist Doug Chabot said high avalanche danger warnings are unusual and the initial one on Tuesday was the first in the center's history for the entire forecast area, which also includes mountain ranges around Bozeman and West Yellowstone.

LOCAL BRIEFS

Avalanche danger high in region's backcountry

The Gallatin National Forest Avalanche Center has expanded its backcountry warning to include every mountain range in southwest Montana.

The danger of avalanche is considered high in the Gallatins, Bridgers, Madisons, the Lionhead area and around Cooke City. New snow has been deposited on an extremely weak snowpack, and both human-caused and natural avalanches are likely.

In addition, the new snow was wet and heavy, adding a tremendous load to the snowpack. Avalanche terrain and runout areas should be avoided, especially slopes greater than 30 percent grade.

For information, call 587-6981 or visit www.mtavalanche.com.

Bozeman Chronicle 1-29-03

FACULTY and STAFF NEWS

David Lovejoy, RDP Adventure Education (*RDP '73*): To kick off my sabbatical year, I was able to spend January 2003 involved with the Gallatin National Forest Avalanche Forecast Center in Bozeman, Mont. Alumnus Doug Chabot (*RDP '86*), who was a student of mine in the past, is now the director of the center. We have gone the full circle and our roles are reversed, Doug now serving as my teacher. Not only was this experience valuable to my own development in snow sciences and avalanche studies, it also was a Prescott College mini-reunion. In addition to Doug, I had a chance to reconnect with Mara-Gai Katz (*RDP '75*), Kent Madin (*RDP '75*), Linda Svendsen (*RDP '75*), Peggy Gurnett (*RDP '74*), Rick Alexander (*RDP '83*) and Tim Murphy (*RDP '99*), each of whom has had the good fortune to make Bozeman their home.

Billings man critical after avalanche

LIVINGSTON (AP) — Authorities on Monday released the names of two snowmobilers who survived being buried in weekend avalanches. One of the victims remained hospitalized.

Ray E. Lang, 54, of Billings, was listed in critical condition in a Billings hospital, after being buried Sunday afternoon on Sheep Mountain, about five miles northeast of Cooke City.

Bill Blackford, a first responder with Cooke City Search and Rescue, said Lang was snowmobiling with a group along the base of the mountain when the avalanche came down.

All the riders had transceivers and other snowmobilers in the group estimated Lang was buried with his snowmobile on top of him for about five minutes, Blackford said.

Blackford said Lang never stopped breathing but was still unconscious when he was placed on the aircraft to be flown to Billings.

Authorities also released the name of the 17-year-old North Dakota boy who was injured Saturday morning in another avalanche on the back side of Daisy Pass near Crown Butte, east of Cooke City.

Grant Vigesaa of Cooperstown, N.D., was "high-marking" — running a snowmobile up a steep slope as far as possible before turning around — when the avalanche hit, the National Park Service said in a report.

Vigesaa was in a group that was not equipped with emergency transceivers, the Park Service said.

Other riders in the area heard screaming and yelling following the avalanche and searched for the buried boy with avalanche probes, finding him after about 15 to 20 minutes, said Larry McKee, winter sports coordinator for the U.S. Forest Service and Park County coroner.

When found, Vigesaa was not breathing and was blue, but rescuers performed CPR and revived the boy, who refused further medical attention, McKee said.

The Gallatin National Forest Avalanche Center issued an avalanche warning Monday for the southern Madison and southern Gallatin ranges, the mountains around West Yellowstone and Cooke City and the Washburn Range in northern Yellowstone National Park.

The center said the avalanche danger is high on all slopes because 1 to 2 feet of snow recently fell in the area on top of a weak snowpack.

Billings Gazette 12-31-02

BURIED ALIVE AND LOVING IT

YOU REALLY CAN'T UNDERSTAND AN AVALANCHE, SAYS SNOW SCIENTIST ED ADAMS, UNTIL YOU'VE BEEN RUN OVER BY ONE – BY DAVID HOCHMAN

ED ADAMS LIKES TO SAY HE'S BEEN buried alive more than anyone else on the planet. In a heavy winter it can happen seven or eight times if he's lucky. Usually he brings along a shovel and a half dozen colleagues from the Department of Civil Engineering at Montana State University, where Adams gets paid to think about snow and ice all day long. The team typically sets out at dawn after a big snowfall and heads into the shimmering backcountry behind Bridger Bowl Ski Area, near Bozeman. As they go, they slip past yellow out-of-bounds ropes and a thicket of bright orange signs: CLOSED! DANGER! THIS IS STEEP HAZARDOUS TERRAIN! STAY TOGETHER! AVALANCHE AREA!

At 8,000 feet, halfway up a shadowy bowl called Revolving Door, they excavate the small wooden shed that is their research station. Supplies are unloaded and instrumentation is set, and at last, Adams and two or three fellow snow junkies seal themselves inside the cramped shack, giving their blinking avalanche transceivers a final check. Another member of the team then hikes uphill, lights the fuse on a two-pound cast-primer bomb, and watches as hundreds of tons of snow are unleashed on the hill. If all goes well, the shed survives yet another hit, and Professor Adams, emerging like Lazarus, has another frostbitten tale to tell his students over pitchers of Moose Drool beer.

After more than 20 years of research, Adams knows that the best way to comprehend the power and majesty of avalanches is to be run over by them. Since 1994, when he and his colleagues Scott Schmidt and Jim Dent first bolted plywood beams onto a Volkswagen-size boulder in Revolving Door, Adams, a 52-year-old ex–New Yorker with a gentle manner and a Grizzly Adams beard, has withstood dozens of controlled avalanches, from wispy little drifts to massive slides that rage like freight trains over the shed's pitched roof.

"It does seem a little silly, doesn't it?" Adams said inside the bunker as another slide was about to be triggered last March. A few days earlier, he had called me in Los Angeles to see if I wanted to experience an avalanche from the inside out. Now he and graduate student Dan Miller, an Air Force major with little round spectacles, were standing at their laptops, ready to monitor the flow's velocity, depth, and temperature changes. With their mittens and neck gaiters, they looked like giddy schoolkids on the first snow day of winter. "There is a science to all this," Adams said, biting into a frozen egg salad sandwich. "I swear."

Bunker down: Inside this research station, snow guru Ed Adams, student Dan Miller, and seriously spooked author David Hochman wait for the avalanche to hit.

THIRTY-FIVE LIVES WERE TAKEN BY AVALANCHES IN THE UNITED States last winter, the most since such numbers started being tracked in 1951. Until the 1970s about five people a year died in avalanches in the U.S. As more people began exploring the backcountry, that number grew steadily, reaching 20 deaths a year by the 1990s. In 2000-01, 33 people died across the country, more than in any other nation. It was the first time the U.S. claimed that grim distinction.

But while enormous resources are devoted to avalanche research and prevention in Europe and Japan, the U.S. government has all but eliminated funding in the last decade. Researchers pretty much have been left, well, out in the cold. "Don't be impressed," Adams deadpanned as he secured the weather-beaten tarp that is the

PHOTOGRAPHY BY ANNE SHERWOOD

shed door. "We basically bootstrap this."

Heavy on duct tape and junkyard ingenuity, the drafty eight-by-ten-foot hut looked like a backwoods bomb shelter. "We borrowed our design from Ted Kaczynski," added Schmidt, a slide specialist with the Gallatin National Forest Avalanche Center. To calculate the depth of the avalanche flow, the researchers attached a metal potentiometer to an old bicycle hub. To gauge the snow's force and friction, they slung panty hose over a sensitive metal plate. Empty tuna cans were originally used to protect the 99-cent infrared light sensors that measure speed along the slide path. Schmidt once loaded giant gum balls into plastic tubes outside the shed as a way to understand how snow moves. "I had to pick out all of the white gum balls because they wouldn't show up in the snow," he said. "Of course, we never saw gum ball one when we played back the video."

And yet the group has made some important discoveries. The main one is that on a uniform slope an avalanche slides like a block rather than flowing like a liquid, as most researchers previously assumed. That helps predict the distance an avalanche can travel. They also confirmed the long-standing theory that friction heats the mass as it moves downslope, which may help explain why snow crystals fractured by an avalanche will rebond the moment the flow comes to rest, hardening like quick-setting cement. That's no consolation to the victims who experience the terror of being immobilized in the flash-frozen snow, but it's one more piece of data to feed into the computer models. The ultimate goal is to know as precisely as possible what triggers avalanches, how best to predict them—and, perhaps, how best to survive them.

On that March morning, though, all Adams wanted to do was to get buried. Inside the shed, the "Fire in the hole!" warning crackled through the walkie-talkies, giving us 90 seconds to batten down. First would come the explosive concussion. Then, as Miller said, perhaps as a joke, "It's in God's hands."

Got ammonium nitrate? Scientist Ed Adams uses bombs like this one (above) to trigger avalanches. Top: Plexiglas and plywood are all that shields the scientists from slides. Left: Adams, post burial.

TWENTY YEARS AGO, MOST AVALANCHE victims were backcountry skiers on the wrong slope at the wrong time. But since 1990, 98 snowmobilers have died, making that group the most at risk. "Backcountry skiers take all day to get to a great slope," Adams says. "Snowmobilers can hit 40 or 50 slopes a day. That raises the risks exponentially."

Aggravating the problem is a popular technique known as high marking, in which a snowmobiler—or, more often, a convoy of snowmobilers—shoots as far as possible up the side of a steep virgin slope only to rocket straight down. High marking is competitive and extremely risky, yet many snowmobilers are unaware of the danger.

On March 9, 2002, Alan Eliason, 29, a software tester from Colorado Springs, and some relatives were enjoying a sunny Saturday of snowmobiling near Buena Vista, Colorado. A foot of new snow had fallen, and the backcountry was crisp and glittering. Around 11:30 a.m. Eliason watched his brother-in-law shoot up an untracked slope, then followed him, blazing uphill. A third of the way up, his brain registered that something wasn't right.

"It looked like the snow was dancing," Eliason says, "like someone was taking a frying pan full of flour and shaking it. I thought, Maybe it's the wind. But then I realized the snow was coming straight at me!"

Eliason ditched his snowmobile and took off running, but he managed only a few strides. "Imagine getting hit by the biggest wave of your life, but instead of the water receding, it just continues pounding and pounding," Eliason says. "I couldn't tell which way was up, down, straight, or sideways. I tried to swim, but the stuff was so heavy, it was like drowning in concrete."

Eliason tumbled 200 feet and was frozen under four feet of white. He couldn't move a finger; he could barely breathe. Snow was packed in his ears, his jacket, and in every imaginable air pocket. "It was pitch-black and dead silent," Eliason says. "I remember thinking, I've never known anybody in an avalanche and now I'm going to die this way."

Eliason's group had ignored all of the warnings. The snow was fresh, and they'd seen slides on other slopes. Worse, nobody in the party had a shovel, a probe, a transceiver, or avalanche rescue skills.

To say that Eliason was lucky is a major understatement. Someone in his group

spotted the tip of his snowmobile ski sticking just inches out of the snow. There were two snowboarders nearby with the proper safety gear and training, and they probed and shoveled. After 20 harrowing minutes, Eliason was dug out, his face edging toward purple, his pulse down to a few beats per minute.

Only 25 percent of avalanche victims who are completely buried survive, according to Adams, and after 15 minutes, the chance of survival dips precipitously. Alan Eliason shouldn't have made it. But as soon as his air passage was cleared, he coughed up some snow, blinked back to consciousness, and walked away with little more than a sore knee and a missing boot.

"I have to admit I was pretty naive and ignorant," he says. "I honestly thought avalanches only happened in movies."

ED ADAMS LOVES SNOW. HIS OFFICE ON Montana State's Bozeman campus, which I had visited before we set out to trigger a slide, is a shrine to it. Other people keep pictures of the wife and kids on their desk. Adams had microscopic close-ups of snow crystals. An old snowshoe dangled from the cinder-block wall. There were snow globes, a photograph of Adams atop Mount McKinley, and the obligatory bumper stickers: LET IT SNOW! and I BRAKE FOR PENGUINS.

Adams grew up on New York's Long Island and majored in English at Mount St. Mary's College in Maryland, but his pivotal moment came in 1973 while waiting tables at the Alta Ski Area in Utah. Over the Christmas holiday, a series of avalanches plowed into the Alta Lodge, smashing windows and filling all three floors with snow. A woman was buried in her bed, a Volkswagen ended up on the roof, and Adams suddenly realized what he wanted to do with his life.

"There was a bifurcation," he said. "Either stay a ski bum or take this avalanche business seriously."

Adams read every book he could find on the subject and signed up for the first course ever offered at the American Avalanche Institute in Jackson, Wyoming. Later he worked as a field technician for the U.S. Army Corps of Engineers Cold Regions Research and Engineering Laboratory before finding his way to Montana State, where veterans from the Army's Tenth Mountain Division had established the country's leading avalanche research center. Since then he's served as the chairman of the International Snow Science Workshop. He's made frequent trips to Antarctica, working with an international team to dredge up the world's oldest ice core sample, a frosty mass more than a million years old.

That's the sort of research that lands Adams his academic laurels. But avalanches are what stir his soul. "As a force of nature," he said, "I can't think of anything more awesome than the power of snow moving down a slope. Trying to understand that process encompasses virtually every aspect of physical science I can think of."

> **"ED ADAMS LOVES** snow. His office is a shrine to it. Other people keep pictures of the wife and kids on their desk. Adams had close-ups of snow crystals.

Before we set out for the shed, Adams wanted to tell me what would happen if things really went wrong. With fat flakes falling outside his office window, he walked me through the worst-case scenario—the so-called climax event that is both Adams's Holy Grail and his biggest nightmare.

"We got data!" The crew, having gathered speed and other stats on the avalanche, digs out the shed.

The perfect avalanche begins taking shape in the autumn. The first snowfall might come in October, laying down a white blanket over the backcountry. The trouble starts when a major freeze sets in after that. Since the ground is warm and the air temperature is cold, vapor moves through that base layer of snow, causing the original six-sided snowflakes to lose their "arms" and recrystallize into tiny square pellets.

"Imagine a layer of tiny marbles," Adams said. "Put anything on top of that and you can guess what happens." New snow doesn't adhere well to a weak base, so early season avalanches—and early season avalanche deaths—are common. "All it takes is an animal or a skier stepping onto a slope," Adams said, "and that top layer starts sliding."

But if the conditions are right—perhaps cold, dry snow is falling on sun-warmed drifts—the new snow will bond better and the pack will get deeper. As Adams put it, "A layer cake is being created, and it's a very dangerous layer cake."

Even good weather can be a bad thing at this point. Warm days and crisp, clear nights might make for gorgeous conditions in the backcountry, but the melting and refreezing weakens the top layer. Since new snow won't bond to a weak surface, a fresh, big dump will just sit there waiting for something—or someone—to help gravity do its thing.

In the ultimate scenario, a big wind would set in, covering the top layer of snow with a crust firm enough to support a person. Top that off with a few inches of fluffy new snow, then bring on a skier who thinks he's just found the perfect slope. The poor soul might even get in a few powdery turns. But then it would happen. Just below the surface, that crisp wind-packed layer would start to shatter. "The telltale sound is a *whumph*," Adams said, "and it's terrifying." Adams heard it once when he was skiing. "It

AIR CARE

A NEW DEVICE HELPS BURIED VICTIMS BREATHE EASIER

**PERSONAL AIR BAGS? SNOW SNORKELS? ¶ Gearmakers will try almost anything to help people survive avalanches. Among the latest innovations is the AvaLung II, an undersnow breathing device that is being hailed as one of the most significant advances in snow safety since the debut of the avalanche transceiver in 1968. ¶ Like any revolutionary invention, the AvaLung II, distributed by Black Diamond Equipment ($120; *www.blackdiamondequipment.com*), is simple. It consists of a breathing hose, a box the size of a deck of cards, and a harness. The idea behind it is that snow is about 50 percent air; a buried victim's warm, moist exhalations, however, lead to the creation of an "ice shield" in the snow around his face, quickly cutting off the supply of fresh oxygen. The AvaLung II's solution: Fresh air is drawn from the snowpack, while warm, exhaled carbon dioxide is vented through the little box, worn on the skier's back. ¶ No avalanche safety device is even close to being foolproof; avalanches are too violent and unpredictable for that. But in product tests some subjects have stayed under snow for an hour and longer. Reports of real-world successes are starting to trickle in, too. Mike Morrissey, 45, a masonry contractor from Denver, was wearing his AvaLung II last February when a massive avalanche pummeled him during a heli-skiing trip in British Columbia's Selkirk Mountains. Morrissey was frozen, Pompeii-style, four feet down, and nearly 40 minutes passed before he was dug out. But he survived. ¶ "I looked up and saw blue sky, and I knew I'd made it," he says. "If I didn't have that thing on, I wouldn't be here today." —*D.H.*

was so loud, I thought it was a jet going right overhead. I looked around and nothing slid, but I was standing in the middle of a jigsaw puzzle. All this energy had been released."

A skier in a full climax scenario wouldn't fare as well. He would notice giant cracks all around him and then see big slabs of snow moving downslope. Or not, because he'd be moving, too. One of Adams's colleagues at Montana State, Ladean McKittrick, said he was skiing on nearby Ross Pass once when he noticed "all of the trees moving uphill. It took me a minute to realize it was me who was moving. The whole slope had cut out. Somehow I managed to race across the slope and grab onto a tree."

In a climax avalanche, the power of the snow—100,000 tons or more of raging force—would be too much to fight. In less than five seconds, the falling slabs of snow would accelerate to speeds of more than 80 miles an hour. The whole slope would start breaking up as each level of the layer cake fractured in turn. As the seconds ticked away, the chain reaction would rip the snow all the way down to the base. Even with the latest avalanche gear, the skier wouldn't stand a chance. Less than a quarter of the people who die in avalanches are killed because they hit trees or rocks on the way downhill; the rest die from asphyxiation once they're buried.

In this case, the skier would be buried under ten feet of snow or more. "In a climax you're pulling off the entire winter's snowfall," Adams had said. "You're left at the bottom with nothing but the original half inch of sugar snow and some sticks and stones."

INSIDE THE AVALANCHE SHED ON REVOLVING Door, tensions were mounting. The explosion was two minutes late, and Adams was worried; a dud was always a possibility. But then so was a direct hit. If the avalanche came to rest squarely on the shed, snow could back up inside and bury us.

At the edge of the slope, other members of the team stood by with shovels and walkie-talkies. Comparatively, these test avalanches are tiny—less than five feet deep and about 30 yards across. According to Adams, they're about a three if a climax rates a ten.

> **"THE BLAST ROCKED** the mountainside. After a moment of eerie calm, the slide hit the roof, making a sound like a hundred sacks of rice being spilled overhead.

But size isn't everything. "These are pretty typical of what kills people," Schmidt would say later. "We don't lose people in really big avalanches. Recreationalists in the U.S. die in small slides. You get caught, it knocks you on your butt, and suddenly you're buried under four or five feet of snow."

The bomb was suspended over the slope 50 yards above the shed. Three minutes and 15 seconds in, the blast rocked the mountainside with a staccato *bang* that echoed through the valley below. After a moment of eerie calm, the front edge of the slide hit the roof, making a sound that was less like a freight train than like a hundred sacks of rice being spilled overhead: *pfft-pfft-pfft*. And then there was darkness. For a few terrifying seconds, all we could see were the monochrome laptop monitors. The shed had been consumed.

Avalanches move quickly, though, and this one rolled over the shed in less than ten seconds, stopping for good in a fallout area a few hundred feet below. As sunlight flooded back in, the hoots and hollers began. "We got data! We got data!" Adams yelled. Velocity: 32 feet per second. Depth: just over four feet. Temperature: an increase of several degrees inside the pack. It was more evidence about how and why avalanche snow hardens so quickly.

Of course, seeing the glint in Adams's eye as he stepped out into the day, I could tell that the shed project is more than a numbers game for him. An avalanche isn't just a force of nature; it's a metaphor. In the passing of a few seconds, an ordinary day is upended. You could be skiing the greatest run of your life one minute and find yourself under a white blanket of death the next. No wonder Adams wants to know what triggers these monsters. It's like getting a handle on fate itself.

But then again, maybe not. Adams doesn't like to fuss much about higher implications, about confronting death as a way to feel more alive. After the avalanche Adams just carried on. There was equipment to gather and snow samples that needed to get back to the lab. Tiny icicles were forming on his beard, but he seemed content to hang out on the mountain, chatting with the other scientists about thermocouples and melting points.

Just before we left the area, I asked him if he ever got scared. He grimaced a little but then looked back at the shed in all its glued-together glory, and smiled. "What would really scare me," he said, "is if we couldn't do this again." ▲

To read an exclusive interview with avalanche guru Ed Adams, visit www.nationalgeographic.com/adventure. AOL Keyword: NatGeo Adventure.

Bozeman Daily Chronicle 12.28.02

Avalanche education key to backcountry safety

By LARA VAIENTI
Chronicle Staff Writer

The lure of the wild draws hundreds of skiers, hikers, snowmobilers and snowboarders into the backcountry every winter.

But snow activities in the mountains also put adventurers within range of a killer natural phenomenon — avalanches.

Every winter, people are caught unaware and killed or injured by avalanches in the Gallatin National Forest.

But the remedy is as simple as having the right information.

When it comes to avalanches, knowledge and education can save your life, said Doug Chabot, director of the Gallatin National Forest Avalanche Center in Bozeman.

"What people need more than anything else in terms of basic (avalanche) skills is education," Chabot said. "Education makes you able to identify avalanche terrain, as well as what snowpack and weather conditions" contribute to avalanches.

> "What people need more than anything else in terms of basic (avalanche) skills is education."
>
> **— Doug Chabot, Director of the Gallatin Valley Avalanche Center**

"Obviously, the single biggest factor for avalanches is the snow, which is: more snow equals more avalanches," Chabot said.

Avalanche activity is typically seen during or immediately after a snowstorm.

Every time it snows, layers are formed and the relationship between those layers determines the snow stability. For example once a weaker layer (such as frozen dew) is buried with snow, that weaker layer can easily break if stressed by blowing wind or heavy snow.

When too much stress occurs, the snowpack will fracture, provoking the avalanche.

"At the Avalanche Center, we are mainly concerned with human-triggered avalanches," said Chabot.

To that end, the center conducts workshops and seminars and issues a daily avalanche report during the snowy months.

"We let people know how the snowpack is, if and where there is danger of an avalanche, and the weather conditions," said Ron Johnson, a specialist at the Avalanche Center.

To compile the report, specialists like Johnson go out into the field, dig holes in the snow and look at the layers to determine the risk.

This year, at about 8,000 feet, there is about feet of snow making up the "foundation." It's n the best situation in terms of safety, Chabot sai

"We have some weak layers being formed sc because it's been sitting there for so long that it just gets weaker and weaker," he said. "As soon it's loaded with more and more snow, there is p tential for problems."

In addition to education, backcountry adve turers should bring along safety gear — a shov probe poles and an avalanche transceiver.

"Our staff works to pass information to peo it's their own decision then on what to do with Johnson said. "Whether skiing, snowboarding, snowmobiling — it's up to them once they kno how it is out there."

For the daily avalanche report, call 587-6981 visit the center's Web site at www.mtavalanche.c

Lara Vaienti is at citydesk@gomontana.com

Avalanches bury two near Cooke

Both snowmobilers dug out of snow quickly by rescuers

By ALISON PRIDE
Chronicle Staff Writer

Avalanches buried two snowmobilers over the weekend near Cooke City and officials warned that the danger remained high on many slopes due to unstable snow and high winds.

A 54-year-old Billings man was taken by helicopter to a Billings hospital after he was buried by an avalanche Sunday afternoon on Sheep Mountain, about five miles northeast of Cooke City, said Bill Blackford, with Cooke City Search and Rescue.

The man, whose identity was not released by the Park County Sheriff's Department, was snowmobiling with a group below the mountain when the avalanche occurred.

All the riders had transceivers and the other snowmobilers in the group estimated they found the victim in about five minutes, buried with his snowmobile on top of him, Blackford said.

Because the area where the avalanche occurred is in the backcountry, it took rescue workers about two hours to get the man transported to Cooke City, where he was then flown to Billings. Although the man never stopped breathing, he never regained consciousness, Blackford said.

FRONT PAGE - BZN DAILY CHRONICLE 12.30.02

Avalanches/from page A1

A 17-year-old North Dakota boy injured Saturday morning was riding in a group without transceivers on the back side of Daisy Pass near Crown Butte, just east of Cooke City, according to Larry McKee, winter sports coordinator for the U.S. Forest Service and Park County coroner.

Other riders in the area heard screaming and yelling following the avalanche and searched with avalanche probes for the buried teen.

The boy was located in 15 to 20 minutes, McKee said. By the time he was pulled from the snow, he had stopped breathing and had turned blue. Rescuers performed CPR and revived the boy, who then refused further medical attention.

McKee said he also heard in town about two other people who were buried by avalanches Saturday and rescued by other snowmobilers in their group carrying transceivers.

"There are signs of avalanches anywhere and everywhere up here," he said.

Below-average snow conditions and a late start to the season have made everyone anxious to play, Blackford said.

"You just have to be really careful. Sometimes people just forget and get caught."

Alison Pride is at apride@dailychronicle.com

Thursday
January 23, 2003
Livingston, Montana
Vol. 91 No. 71
Fifty cents

THE LIVINGSTON
ENTERPRISE

Ranger on a mission: Page 10

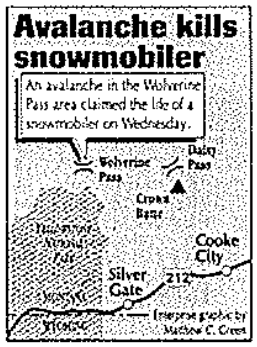
Man killed in Cooke City-area avalanche

By Paula Clawson
Enterprise Staff Writer

A 21-year-old North Dakota man died in an avalanche Wednesday where he was snowmobiling near Wolverine Pass northwest of Cooke City.

Andrew Greicar, of Pisek, N.D., was caught in an avalanche after he snowmobiled out of sight of a friend, according to Park County Sheriff Clark Carpenter.

The friend, Jamie Bennington, 23, of Park River, N.D., was able to find Greicar's location because they both had avalanche beacons. But Bennington did not have a shovel or snow probe so was not able to dig out Greicar, Carpenter said.



"I can't stress enough how important it is to have the right equipment," Carpenter said Thursday. "If you don't have a snow shovel or probe, there is no chance. With the right equipment there's at least a chance you can save someone in an avalanche."

Carpenter said the situation unfolded as followed:

The men arrived in Cooke City Wednesday morning for the first day of a snowmobiling vacation. They were snowmobiling in a meadow to the northeast of Wolverine Peak about 2:30 p.m.

Bennington realized he'd lost sight Greicar and followed Greicar's tracks over a ridge and saw a fresh avalanche had fallen.

"He tried to use a tree branch as a snow probe, but it was too short. Because of the snow conditions he couldn't dig very well with his hands," Carpenter said.

Bennington heard another snowmobile over the ridge and decided to leave to get help. He put the branch into the snow where he believed Greicar was.

Bennington sunk into snow up to his chin when he stepped away from the avalanche area, Carpenter said. The mountains around Cooke City have received nearly a foot of snow since Tuesday night, according to the Gallatin National Forest Avalanche Center.

The snowmobilers Bennington flagged down were search and rescue volunteers.

The volunteers had spent the morning looking for a party of 12 snowmobilers who had been forced to spend the night outside Tuesday when they got lost in the dark. The group had been found around noon and no one in the party was injured.

About a half dozen of the search volunteers were snowmobiling near Wolverine Pass to check radio transmissions and do a general patrol, Carpenter said.

The volunteers found Greicar buried right where the tree branch marker had been placed.

"They did CPR and used a defibrillator but couldn't revive him," Carpenter said.

Carpenter guessed Greicar was buried for at least 30 minutes.

"It only takes five minutes without air to die," he said.

This was the first avalanche fatality in Montana this year. Montana led the nation last year with nine avalanche fatalities, all of them snowmobilers.

Avalanche danger in the Cooke City area was ranked "high" Thursday morning by the avalanche center. High means avalanches are likely.

On Jan. 13, three snowmobile riders near Wolverine Peak were hit by an avalanche, according to an avalanche center report. Two were able to dig themselves out and the third was rescued by snowmobilers using shovels and probes. No one was significantly injured.

Big Sky Weekly Jan 3rd, 2003

Signs of Snowpack Instability: What are They and What do They Mean

By Ron Johnson, Avalanche Specialist for GNF Avalanche Center

Any avid backcountry skier, snowboarder, or snowmobiler, is well aware of how thin the snowpack was during the Christmas Holiday. What may be surprising is that the thin snowpack was unstable. Many avalanches both human triggered and naturally released occurred during the middle of December. In addition to the avalanche activity, many backcountry travelers observed the snowpack collapse, which is often associated with a distinct whoomphing sound. They also noticed cracks radiating from their skis or snowmobile. These warning signs become apparent when the snowpack is unstable. Recognizing these signs and understanding what they mean are important because avalanches occur when the snowpack is unstable.

The snowpack is made up of different layers of snow. These layers are formed by different storm events and the dry spells that occur between them. During the course of a winter, differences in temperature and pressure within the snowpack cause these layers to change. Generally, the snowpack has two types of layers. There are weak layers and slabs. Weak layers tend to be softer and often are made of loose, sugar like, ice crystals. Slabs are often made up of harder snow and are cohesive. The cohesiveness occurs because the snow crystals are typically smaller, more rounded and better bonded to each other than the ice crystals found in weak layers.

A snowpack that consists entirely of weak snow isn't always unstable or dangerous. It is common, early in the season, to have very weak snow; you know the kind...sugary, bottomless snow that doesn't provide a very good base for skiing or off trail riding. While unpleasant, this type of snowpack isn't necessarily dangerous. But it can become dangerous when a more cohesive layer of snow forms on top of the weaker snow. A slab on top of a weak layer is the first requirement for developing an unstable snowpack.

Just because there is a slab on top of a weak layer, doesn't mean that the snowpack is unstable. Another requirement for developing an unstable snowpack occurs when the stress being applied to the snowpack is just about equal to the strength of the snowpack. Obvious signs of instability indicate that the balancing act between the strength of the weak layer and the stress being applied to the snowpack is on the verge of being tipped in favor of producing avalanches.

Cracks radiating across the snowpack are the final requirement for an unstable snowpack. These fractures indicate that the slab is able to propagate fractures when the strength of the weak layer is overcome by the amount of stress being applied to the weak layer. If fractures can't propagate across a slope, an avalanche is not likely to release.

Collapsing of the snowpack and cracking of the snowpack are obvious signs that the snowpack is unstable. Failing to heed these signs often lead unwary travelers onto slopes that if steep enough produce the most obvious sign of snowpack instability, which is an avalanche!

Information about current and past snowpack conditions for the mountains of Southwest Montana can be obtained by calling the Gallatin National Forest Avalanche Center at 587-6981 or via the Internet at www.mtavalanche.com.

News & Views

Couloir Magazine
JAN 2003

Avy Data via s/w

Say goodbye to broken pencils and wind-whipped pages. Doug Chabot, Director of the Gallatin National Forest Avalanche Center in Montana, recently completed the final stages of a project allowing snowpit profiles to be written using Palm Pilot technology.

Information collected from a snowpit includes depth of the snowpack, the layers present in the snowpack, and the strength, structure, temperature gradients and stability of these layers. This information along with other variables such as recent avalanche activity, slope angle, and weather is used to help predict the stability of the snowpack and the likelihood of avalanches. Currently this information is entered into a waterproof book in the field and then rewritten for legibility indoors. According to Chabot, snowpit information is only entered into the computer following an avalanche incident, so there is no quick means of searching through all past data.

"This makes it difficult, if not almost impossible to share local pit profile information with other researchers and professionals, and wastes tons of time in the rewriting phase," explains Chabot.

But all that will be changing. Local mountaineer Conrad Ankers' Midas touch secured a grant for $20,000 through Omega Research Group. This grant money was used to hire a software writer to develop a Palm Pilot program specifically for recording pit information. Chabot says the project has three goals in mind, "We want to make the Palm Pilot easier to use than a pit book by using all drop down menus so you can select variables such as depth layers, crystals, hardnesses and just point. Then we want to be able to plug it right into the computer back in the office and get a schematic drawing of a pit profile. Finally we want to put it into a searchable format on a database that all avalanche professionals can put data into and also search."

Chabot cites a frustrating recent experience where he was hunched under a towering pile of pit books collecting specific information on stability test results, as the impetus for this project. He hopes that having all this data in a searchable database will expedite access to the information, which until now has been an incredible handicap for research.

Chabot sees this project having implications all the way down the line from avalanche professionals, university researchers, NOLS instructors, and heli ski operators to recreational skiers who keep pit information. The software will be free online and downloadable to your Palm Pilot, hopefully by February 2003 at www.snowpilot.org. There are sure to be some bugs to work out in the beginning, but Chabot enthusiastically sums it up as "an exciting project that will make our geeky lives easier."

—Annie Fast

The New Digital Transceivers

Margo Humphries
Outdoors Writer

Planning on venturing into the backcountry for some excitement this winter? Especially with the unstable snow pack and high avalanche risk facing Montana this year, an essential item to have when in the backcountry is an avalanche transceiver. Although a transceiver is no guarantee against avalanche deaths, the new digital technology found in the latest transceivers is making finding the victim easier and faster than ever.

Just six short years ago, avalanche transceivers required extensive practice and time to be successful. When searching, a person, often in extreme panic, had to fumble with earphones, listen to muffled beeps, and use trial-and-error search techniques to attempt to save a life.

Today, however, digital technology relieves the searcher from the process of having to interpret the victim's signal. All beacons use analog (non-digital) technology to send and receive the electromagnetic signal from the victim's transceiver. The difference in a transceiver with digital processing is in how that signal is interpreted. Rather than the searcher decoding the signal, the computer inside the transceiver brings in the signal and re-formats it to be read easier. It does this by receiving the signal, filtering out irrelevant noise, adjusting the sensitivity, determining the direction, measuring the distance, and providing information to the user in visual displays. As a result, this technology allows the victim to be found faster. It also requires less routine practice than the older analog-only models.

A dual-receiving antenna was first introduced in the Tracker DTS transceiver by Backcountry Access. The main advantage of a dual-receiving antenna is that it allows for extreme precision in determining the direction from which the victim's signal is coming. In addition, it no longer requires searchers to travel in a grid pattern to pinpoint the victim in the last three meters of the search area. The grid that was required by older models was very time-consuming during a crucial phase of the search.

www.mammut.CH

The best safety you can buy: a Barryvox made by the Swiss.

According to Ortovox, the worldwide leader in avalanche transceivers, half of all avalanche accidents involve more than one buried person. Because of this, every avalanche transceiver must have features that allow it to search for multiple victims. While analog transceivers require much concentration and practice in interpreting and distinguishing between multiple signals, digital transceivers automatically isolate the closest beacon signal.

Why buy a transceiver? The price of a digital transceiver ranges from $229-$299, and hopefully it will never have to be used in a real-life situation. But a 1997 study by the Swiss Federal Institute for Snow and Avalanche Research found that nearly 100 percent of avalanche survivors are found by companions within their own party, not by outside rescue teams. Transceivers have repeatedly proven their ability to save lives in the event of an avalanche, and the new digital technology is only increasing their efficiency.

There are many things to consider when purchasing a transceiver, as there are so many models currently available. One important factor is the range from which the transceiver can pick up a signal. According to Jeff Schussler of the Round House Sports Center, "Snowmobilers tend to trigger larger avalanches, so they need a transceiver with a larger search area than skiers." Often times a large receiving range is a marketing concept that can be counterproductive. It takes in more background noise, thus weakening the signal. Search extent of beacons can be anywhere between 20 meters and 85 meters, with 50-75 proving the most sufficient.

The X1 from Ortovox came out just this year and has taken over the market. It is extremely easy to use, even for someone who has never before used a transceiver. "Although there is nothing like getting out there and practicing," said Adam Ruther of Barrel Mountaineering, "they'd have the best chance of finding someone with the X1." In addition to providing a shorter search time due to the efficient microprocessor, the Ortovox X1 features a comfortable one-strap system that emits a signal automatically if the transceiver is being worn. It can't accidentally turn off while being worn, and features the quick and easy switch-over between normal transmitting mode to receiving mode in the

see Transceivers, pg. 10

BZN CHRONICLE 2-4-03 FRONT PAGE

Snowmobiler dies in Crazy Mountains

By RON TSCHIDA
Chronicle Staff Writer
and The Associated Press

A Wilsall man died Sunday after he was buried in an avalanche while snowmobiling in the Crazy Mountains, Park County officials said.

Sheriff Clark Carpenter identified the victim as Bryan G. LaHaye, 33.

"According to witnesses, the victim was hill climbing and got stuck in the snow," Carpenter said. "When he tried to get unstuck, the avalanche happened."

Bryan G. LaHaye was killed in an avalanche southeast of Sugarloaf Mountain.

LaHaye was with a group of about a half-dozen friends and family members about one-and-a-half miles southeast of Sugarloaf Mountain.

The avalanche, a slide about 60 yards wide and 300 yards long, occurred about 4 p.m. and the sheriff's office was notified about an hour later. Search and rescue teams from Clyde Park and Wilsall responded with dog teams.

However, by the time rescuers were entering the area other snowmobilers had already recovered LaHaye's body, Carpenter said.

LaHaye was not wearing a transceiver but other snowmobilers were able to find him with probes. He had been buried under about three feet of snow.

(More on **Snowmobiler**, page A8)

Snowmobiler/from page A1

Carpenter said recent, heavy snowfall has created extreme avalanche danger "all the way from Cooke City to Wilsall."

The Gallatin National Forest Avalanche Center has issued a backcountry avalanche warning that continued Monday for the mountains around Cooke City and the Washburn Range in northern Yellowstone National Park.

In the Bridger and Gallatin mountains, avalanche danger varies from high to moderate depending on the steepness of the slope and whether it has been recently windloaded, according to the center's Web site, http://www.mtavalanche.com/.

Recent rain and snow has been deposited on an extremely weak snowpack, according to the site.

"I just want to emphasize the importance of safety equipment, the locators, the probes," Carpenter said. "Anyone going up there just has to exercise extreme caution."

Backcountry recreationists should check the avalanche center Web site for current conditions before heading out, Carpenter said.

LaHaye was the second person to die over the weekend — and the third person to die this year — in Montana avalanches. Jason Troyer, 21, of Fairfield, died Saturday while snowmobiling in the Copper Creek Bowl area northeast of Lincoln.

Ron Tschida is at rtschida@gomontana.com

I Saw the Perfect Avalanche

By Ron Johnson

THE AVALANCHE REVIEW
FEB 2003

On December 18, 2002, I saw the "perfect avalanche" on Lionhead, near West Yellowstone, Montana. I was with Karl Birkeland of the U.S. Forest Service National Avalanche Center and Spencer Logan, who is a graduate student in the Department of Earth Sciences at Montana State University. Their objective was to gather field data for a research project while I checked snowpack and avalanche conditions for the Gallatin National Forest Avalanche Center.

Two weeks prior to this trip I was on Lionhead with my colleague, Doug Chabot. We found an ice crust that had formed from rain, which fell the day before Thanksgiving. The ice crust was covered by a few centimeters of near-surface faceted snow, and large surface hoar crystals produced a fuzzy snow surface. A few minor storm events buried these layers with the most significant one depositing 25 centimeters of snow on December 15-17th.

The morning of December 18th was cold and clear. When we arrived at the slope, we found that a dry slab avalanche had naturally released sometime that morning. I measured the crown face, checked the slope angle, and identified the slab, weak layer and bed surface. As I wrote the numbers into my notebook, I realized I was looking at the perfect avalanche.

It was the perfect avalanche based on the results of various field studies on the characteristics of dry slab avalanches, which are summarized in several publications, including *The Avalanche Handbook*. Jürg Schweizer lists typical values for several parameters of slabs and weak layers in a 1999 paper. Some of these values are:

Parameter	Typical Value	Range
Slab Density	200 kg m-3	100-300 kg m-3
Slope Angle	38°	30-45°
Slab Depth (perpendicular)	0.5 m	0.3-1 m
Weak Layer Thickness	10 mm	1-15 mm

Values for the avalanche we saw were:

Parameter	Value
Slab Density	153 kg m-3 200 kg m-3 for layer above the weak layer
Slope Angle	38°
Slab Depth (perpendicular)	0.5 m
Weak Layer Thickness	10 mm

There you have it: the perfect avalanche.

As I struggled to keep my footing on the icy bed surface at the crown fracture, I poked at the slab and tickled the surface hoar that formed the weak layer. I understood how these layers formed. The set-up for this avalanche was obvious. There were also several things about this avalanche that were not obvious. What upset the balance between stress and strength within the different layers of the snowpack? Why did fractures propagate across the slope? Could I have predicted the time this avalanche released? These questions baffle me, but pursuing the answers inspires me. That is why this was *my* perfect avalanche.

Ron Johnson is an Avalanche Specialist at the Gallatin National Forest Avalanche Center and a Climbing Ranger at Grand Teton National Park. He developed his passion for snow in the cold, flatlands of Minnesota while riding underpowered snow machines.

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Backcountry Conditions

Nick VandenBos
Outdoors Writer

Bozeman sits in prime backcountry skiing location. Surrounded on almost all sides by mountains, we live in an area seemingly made for this exhilarating activity. It doesn't take much effort, just a short drive, to arrive at the foot of our winter stomping grounds, and from there, how far you get depends on muscle and motivation.

Of course, this all comes with a catch. In the backcountry, there's no one to hold your hand and guide you to safety. When skiing in a resort, worry about aspect, wind direction, and snow pack stability is usually far from the mind. But get outside the boundary ropes and this all changes. Where the lift lines end so too do the luxuries of carelessness and inattention.

Backcountry conditions are in a constant state of change. Wind, fluctuating temperatures, and precipitation are just a few of the factors involved. Because of this, constant vigilance is needed when playing in the backcountry. The Gallatin National Forest Avalanche Center (GNFAC) issues a daily avalanche forecast at seven thirty every morning. This is an excellent resource to make use of when determining where to go and whether or not to head out for the day. Fellow skiers can also be a helpful source of information.

Two snowboarders died in this slide on Mt. Baldy in Utah.

Out on the slopes, safety hinges upon your ability to evaluate your situation and to act accordingly. The only way to be completely safe is to stay at home, but you can mitigate your danger by education yourself about backcountry travel. Again, the GNFAC is an excellent resource, and offers avalanche safety course sessions during the winter. Although experience does not guarantee your safety, caution and common sense will go a long way towards keeping you from harm in the backcountry.

So the next time you get the urge to head out, make sure you know what's up. Telephone GNFAC for the avalanche report, and pay attention to what the weather is doing. Don't let the siren call of untracked snow dull your senses to the current conditions, or taking the ride of your life might not turn out to be quite the experience you had hoped. ❖

HANK TALK 2-14-03

GET UP EARLY FOR SWEET SPRING CORN

by Doug Chabot

Skiing in the spring is one of my favorite things to do. The days are warmer and longer, and if you hit it right, backcountry "corn" can seem like 2000-foot groomers, without the cost or the crowds. However, to taste the fruits your timing needs to be impeccable.

Spring cycles of warm days and cold nights turn the snow surface into big grains called "corn snow." For a few hours, between the rock-hard, bulletproof early-morning crust and the slushy afternoon hours, you'll be in carving heaven.

The spring sun is higher in the sky, which increases the angle and amount of solar radiation hitting the snowpack. In essence, the snow begins to melt and water percolates down into the snowpack. If the temperatures freeze hard, the snowpack seizes up like concrete with the frozen water channels acting like rebar, creating very solid bonds reinforcing the snowpack. These are times when the avalanche danger is low and nothing short of a nuclear bomb will get it to move.

As the sun rises, the temperatures warm and the frozen surface starts to melt. This is the window you're shooting for: the initial melt. If you go out too early, you'll chatter the fillings out of your mouth trying to make a turn. And if you sleep in and wait too long, you'll find yourself sinking to the ground as the snow loses all its strength. The bad thing about waiting too long—besides the hateful skiing conditions—is that the avalanche dangers will rapidly rise too.

Dry snow avalanches occur because weak layers are loaded to the point of failure. It snows and snows until the layer fails. Wet avalanches, on the other hand, fail because the layers themselves lose strength as their bonds melt. If it gets warm enough, the bonds melt through the entire snowpack and you crash to the ground on your skis—not a pleasant experience.

How can you tell if the avalanche danger is rising? If you notice that pinwheels are spinning downhill, getting bigger as they roll, until they resemble Goliath-sized cinnamon rolls, it's getting too late to ski. The same if you step out of your skis and sink past your boots in wet glop. Both of these are signs that the snow is losing strength and the avalanche danger is worsening. Ideally, the snow will freeze again overnight, giving you another chance of making turns the next day. However, if there are three or more days of round-the-clock above-freezing temperatures, look out, because large avalanche cycles can follow.

Nature will reward those disciplined enough to get up early. Imagine skiing a long, open run with your edges biting, carving the perfect turn. It's there if you want it.

Doug Chabot is the Director of the Gallatin National Forest Avalanche Center.

PHOTOS COURTESY OF DOUG CHABOT

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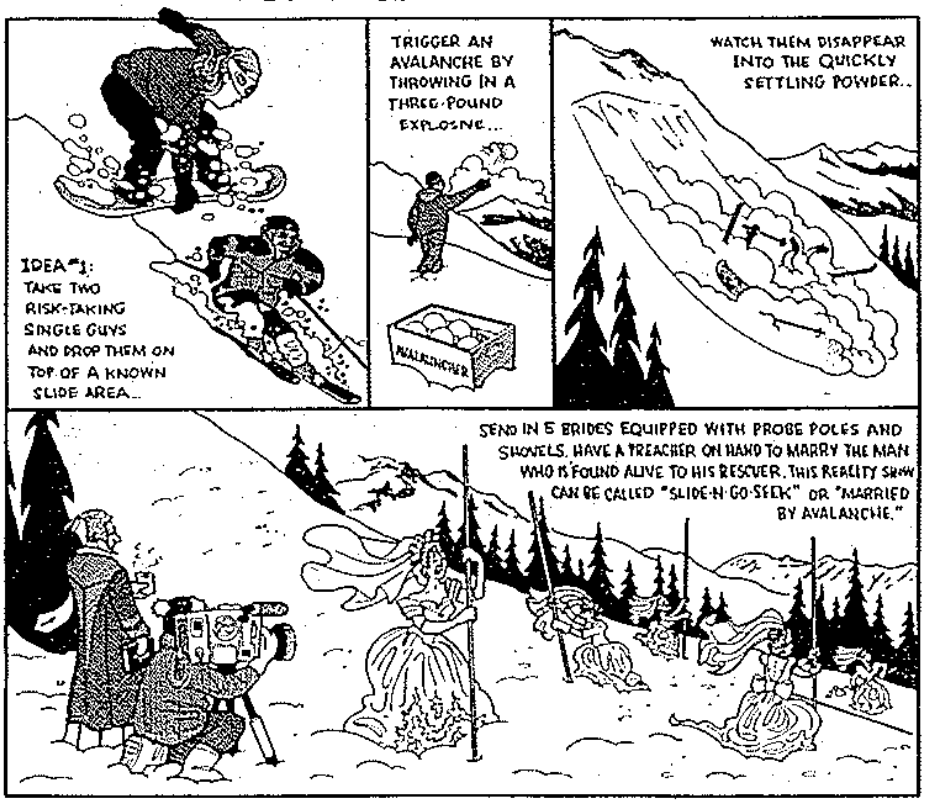

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